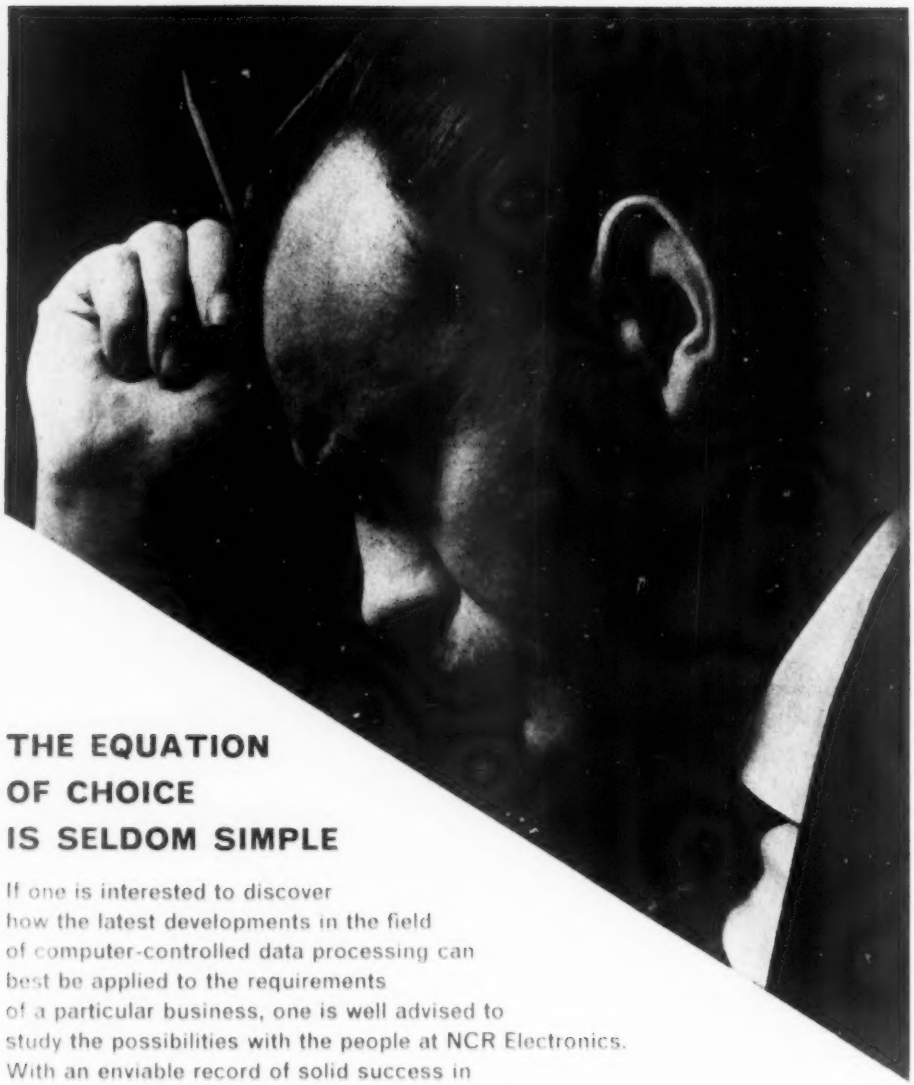
AUTOMATIC DATA PROCESSING

Epidemic at the chemists

How to run the computer department

Can small firms use punched cards?

Animal recipes by computer



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AUTOMATIC DATA PROCESSING

VOL 2 No 11 CONTENTS NOVEMBER 1960

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AUTOMATIC DATA PROCESSING

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The IDP Bit

British industry has been (the) less well prepared for computers because it has used punched card systems on a narrowed field of operations and has not had such a good background of experience for 'integrated data processing'.

This suggestion from the preface to a supplement on computers in commerce which *The Times* published recently is as good a point as any to start chewing the hard bit of IDP, particularly as the concept got several honourable mentions in more than one article in the supplement.

The trouble with the word 'integrated' is that in the data processing context it means different things to different people: if one company abstracts automatically sales figures while its invoices are being prepared it may consider itself 'integrated', while another might label this a purely *ad hoc* solution to a particular problem. Also what you integrate—or ought to—quite apart from how you do it, will always vary. Still, it is possible to say that IDP has to do with linking up discrete operations.

'Integrated data processing', writes Mr J Graham Smith in one of the supplement's articles, 'does not come about merely by installing machines, but by careful appraisal, education and implementation of these exciting new techniques'. The *exciting new techniques* refer to using punched paper tape and edge-punched cards and can be considered as a piece of special pleading (which is none the worse for that), but the premise that you do not get IDP by installing a computer holds good.

In fact a computer may be installed with no thought of 'integration': an insurance company, for example, may acquire a machine for the sole purpose of maintaining policy files on magnetic tape. Also, there are people who think computers should be put to tackle specific jobs first, and that considerations of IDP should be deferred until considerable computer experience has been gained.

The truth, then, is that many computers have been—and will continue to be—acquired with little thought of integrating many data processing jobs; and the reasons for this are that in terms of system studies, program preparation, etc, integrating requires a great deal more effort and demands people of higher calibre (to say nothing of management backing) than do the individual bread-and-butter jobs that are currently favoured.

A child goes to school

She, and [illegible],000 like her.

These are the children who, day by day, attend the 727 schools in the County of Durham. The schools have to be maintained and staffed, the children fed and cared for, and blackboards, books and ink supplied. These—and a thousand other details that affect the lives of the 643,000 citizens of the County—are the daily responsibility of Durham County Council.

To discharge this responsibility the Council employs 20,000 men and women and spends about £27 million each year.

In order to provide a more comprehensive, up-to-the-minute control of their affairs, they were the first County Council in Britain to order the revolutionary new IBM 1401 solid state data processing system.

This impressive machine—of which over 70 have been ordered in Britain since it was announced in October 1959—is small, very fast and of low cost. Controlled by a stored program, it can read up to 800 punched cards a minute, while output can be as high as 600 lines of print or 250 cards punched per minute.

The speed of its calculation is such that it can perform about 5000 additions *per second*.

Besides normal and arithmetical functions, the IBM 1401 has a special combination of machine features and instructions that makes data arrangement and processing quick and easy. It also has comprehensive and automatic checks on all functions, including internal data movement, input and output.

The capacity and economy of the system can be greatly increased by the addition of up to 6 magnetic tape units, each with a data transfer rate of up to 62,500 characters per second. To this can be added the IBM 1406 providing immediate access core storage beyond the basic 4,000 characters by increments of 4,000, to a maximum of 16,000 characters.

The IBM 1401 is ideal for applications where the data processing speeds of conventional punched card equipment are too low, yet where the capacity of larger computers is not warranted.

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The column for quick access to random information

Decentralised Accounting

UNDER the glare of camera flashbulbs, Mr Perring Thoms, founder and chairman of Radio Rentals, put his signature to a £150,000 order for ICT 40-column punched card equipment (see photo above) at the Business Efficiency Exhibition last month. The installation of this equipment, he said, would be part of the continuing expansion pursued by the company in the 'rent or buy' field of radios, televisions and household appliances.

Comprising 11 tabulators with associated devices, the equipment will be used for the daily processing of the accounts of about one million 'subscribers,' in addition to providing statistics for management.

This order underlines Radio Rentals' decision to decentralise accounting functions—the equipment is to go into the company's regional offices—after experimenting unsuccessfully with centralised account recording and updating.

Current Accounts

Yorkshire Electricity order computer

AN English Electric KDP10 is to be the nucleus of the centralised data processing system which Yorkshire Electricity Board are setting up at Seacroft, Leeds. Initially, the computer will handle consumer accounting and will later be extended to cover cost analysis, stock control and payroll processing.

The Yorkshire Electricity Board covers an area of 4,000 square miles and serves some million and a half consumers. The Board works a three-tier system of accounting at branch level, at sub-area level, and at board level. Up till now billing has been done at sub-area level using punched card installations. Now the computer will handle this work at Board level.

Initially, data relating to 25,000 customer accounts will be processed. Cash receipts will be balanced and posted, and reminder notices on overdue payments will be automatically produced, in addition to the printing out of bills for despatch. The breakdown of details contained in the customer records, consumption by class of consumer, statistical analyses, and up-to-the-minute reports will also be obtained from the account processing, which will take up half the computer's working day.

In addition to the KDP10 computer unit, the Seacroft installation will include paper tape readers, monitor printer, two modules of high speed storage, 13 magnetic tape units, two high speed printers and other punched card and paper tape peripheral equipment.

This order is the first computer order to be made by an area electricity board, and the system should be operative in two years. Cost of the system will be in the region of £300,000.

Beechams Outlook

Plans for IDP

DUE to take delivery of a £300,000 Orion computer in 1962, Beechams, the pharmaceutical group, have two years in which to design a completely integrated system for preparing invoices, for customer account handling and producing sales and marketing statistics on the machine. Their aim is to combine all these operations in a single run on Orion, though it is not yet possible to state if it will be practicable to do this.

First, Beechams intend to develop integrated data processing procedures for a very small number of companies within the group, and then hope to bring all the other companies in the group that are in the same line of business within the system.

With the 'guinea-pig' companies invoicing will first be tackled, and then, at monthly intervals, the programs will be extended to integrate the other functions.

Nevertheless, Beechams intend, once they have their machine running, to work in parallel with the existing punched card systems for about a year, as an insurance against snags developing in the computer operation.

CEIR Orders

Computer Centre scheduled

AS forecast in these notes last month, CEIR (UK) Ltd is to open its computer centre in May

1961. The basis of the centre will be two IBM computers, the medium-sized IBM 7090, and the smaller IBM 1401, offering the most advanced computer facilities in Europe, according to CEIR'S Technical Director Dr Douglas. The centre will provide its clients with programming assistance, including program design and construction under contact. CEIR will have at its disposal the massive library of programs of the US parent company, and will also make use of the IBM SHARE library. It will also be able to hire out time on the centre's computers, using either private or CEIR operations.

Dr George, the Vice-Chairman of CEIR (UK) Ltd stressed that the CEIR organisation was wholly independent and unconnected with any computer manufacturers. 'Computers, as such are not our business; we neither make nor sell them; but we have in our organisation the world's largest independent collective experience of their practical use . . .' He expected that, paradoxically enough, CEIR's best customers would be initially firms with computer installations of their own.

O R Award

'Some aspects' bring 1,000 dollars

ALEC LEE, BEA's 32-year-old operational research officer, broke into the news again when it was announced that he had won the Lanchester prize, an award made annually by the John Hopkins University (USA) for the best paper on some aspect of operational research.

His paper, which brought Lee 1,000 dollars plus a commemorative plaque, was based on studies made on the BEA Apron Control Unit at London Airport, and entitled '*Some Aspects of a Control and Communications System.*'

Lee, a mathematics graduate who joined BEA four years ago, made news earlier this year with

BEA'S LEE

Research pays off

studies that were designed to show BEA's sales manager how to buy most advantageously advertising space in the press.

Pioneering Down-Under

Sirius for Melbourne

TWO Ferranti executives, John Nicoll, a programmer and Australian-born sales executive, R Arnott, have just left for Melbourne. They are going to form a two-man pioneer sales organisation to prepare the ground for the computer centre which Ferranti are to set up in about a year's time. The first computer to be installed in Melbourne will be a small Sirius computer (described in this month's Computer Survey) but Ferranti anticipate that this should be followed later by one of the larger machines.

Ferranti are the second British company in recent months to decide Australia is worth prospecting. Mr T R Thompson of Leo was in Australia in July.

Ag. Fish. and Subsidies

Computer for Scottish Agriculture

SOMETHING of the complexity of agricultural subsidy payments was revealed when the Secretary of State for Scotland, Mr J S Maclay, inaugurated the ICT 1202 which the Scottish Department of Agriculture have installed at their Saughton (Edinburgh) offices. For the fatstock guarantee payments, which involve three million animals and 250,000 payable orders per year, payment lists and payable orders have to be prepared for the farmer, a payment advice for the auctioneer, as well as FMC payment statement, an FMC certification statement, statistical tables, with appropriate punched cards for merging and tabulation. For cereal deficiency payments, which differ radically when wheat and rye are under consideration, the procedure is slightly less complex. The computer will also produce agricultural statistics based on a questionnaire prepared twice yearly by all the 63,000 occupiers of agricultural land. The June return contains 140 questions, the December return a mere 80. The computer will analyse these returns to produce parish, county and agricultural statistics.

The computer will replace an elaborate punched card system and Comptometer operation department and will save £250,000 over ten years, it is estimated. In addition to its agricultural work, it will handle the payrolls of the Department of Agriculture, the Scottish Home Office, Education Department, and Health Department.

Money for Deuce

US underwrite Belfast space research

THE United States Advance Research Projects agency is making the biggest financial commitment yet—£65,000 in the first year, and £20,000 during the following six years—to a British University to expand its space research program. The University is Queen's, Belfast, whose applied mathematics department has long been outstanding for its work on

the reaction of atoms and molecules in the upper atmosphere. The grant will enable the department to build its own computer centre; up till now it has bought time on the Deuce belonging to Shorts, Belfast, but now they will have £50,000 Deuce of their own.

Man behind the grant is Professor Bates, head of the applied mathematics department. On a visit to Washington he discovered that Belfast was way out on its own in atom reaction studies, and that there was no comparable research being done in America. Bates put forward a project to the US Government, and this grant is the result. The Deuce will also assist research on satellite instrumentation and an atomic energy project which Queen's are carrying out for UKAEA.

Arithmetic centre

Blackburn to market
Clary units

A NEW term of computerese, 'the arithmetic centre,' is to be introduced into Britain by Blackburn Electronics, by courtesy of the Clary Corporation. The Clary centre is not, as might be thought, a building for arithmetic research or a computer laundrette. It is in fact a low cost general purpose computer for industrial applications which Blackburn have agreed with the Clary Corporation to market in Britain. The 'centre' employs transistorized diode logic and a magnetic drum memory element, and is useful in control operations where digital computations at high speed are required.

Blackburn Electronics will also handle Clary tape perforators with built in encoders and parity checks, able to accept binary coded decimal information and also decimal information. The range of Clary parallel and serial entry printers, capable of addition, subtraction and totalising is also to be made available; these equipments too will accept—and decode during the printing cycle—both decimal and binary coded data.

Bendix hook up

Joint company set up

THE Bendix Corporation of America has entered into agreement with Ericsson Telephones Ltd to form a joint company for the marketing and manufacturing of electronic equipment and high precision industrial and scientific instruments.

Head of the new firm—Bendix Ericsson UK Ltd—will be Dr J H Mitchell, Ericsson's Research Director. His present department in Beeston, the Ericsson Instrument Division, will form the nucleus of the Bendix Ericsson organisation, which will develop new products and manufacture and market some of the Ericsson's and Bendix's existing lines under licence. Bendix products already marketed here will not be affected by this arrangement. B-E will be able to sell their products through the world wide marketing facilities of the parent companies.

No Sleeping Parent

Good-bye, Universal Postal Frankers

FOLLOWING the acquisition in 1958 of the British-owned minority holding in Universal Postal Frankers Ltd, the US parent company, Pitney Bowes Inc, have since woken up to the potential in Europe. A substantial expansion programme, in sales, engineering and manufacturing has been launched, and a major factory project is already well advanced at Harlow New Town. Now UPF are changing their name to Pitney-Bowes Ltd.

UPF have so far, in their forty years of existence, concentrated on the postal meter segment of the Pitney Bowes range. Now it seems likely that all Pitney Bowes equipment will be marketed, including mailing scales, letter openers, counting and imprinting machines, folding and inserting machines and document sorters.

News in Brief

A new Swedish Computer Centre. . . . at Jonkoping, to be used by SAAB airlines for flight calculations. Nucleus of the analogue computer centre is an Electronic Associates PACE 231R computer system, with associated electronic multiplier group, X-Y plotter and eight-channel hot wire recorder.

Puckey Presides. . . . Sir Walter Puckey has been appointed Chairman of the reconstituted BCAC (British Conference on Automation and Computation). This body was set up in 1957, with three study groups, for engineering applications of automation; for computation and automatic control; and for the sociological and economic aspects of automation techniques. These bodies have now been merged. The executive committee includes trade unionist W J Carron and Professor Richardson of the Aeronautical Society.

Three giants plan transistor factory. . . . As a result of the pooled research facilities and resources of three rival firms, English Electric, Ericsson Telephones and the Automatic Telephone Company, an £850,000 plant for semi-conductors and other transistorised components is to be erected in Basingstoke. The plant will cover an area of 120,000 square feet, and should be operative in 1961. This will gradually take over the work now carried out at the Ruislip works of the three giants' joint subsidiary Associated Transistors.

Change of address. . . . The sales offices of Gate Electronics are now located at: 71 Great Russell Street, WC1.

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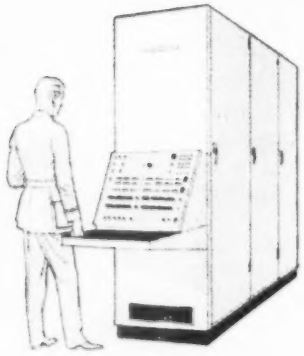

* Because the AEI 1010 can handle the tremendous volume of data at the high speed required for peak operational efficiency of the RAF.
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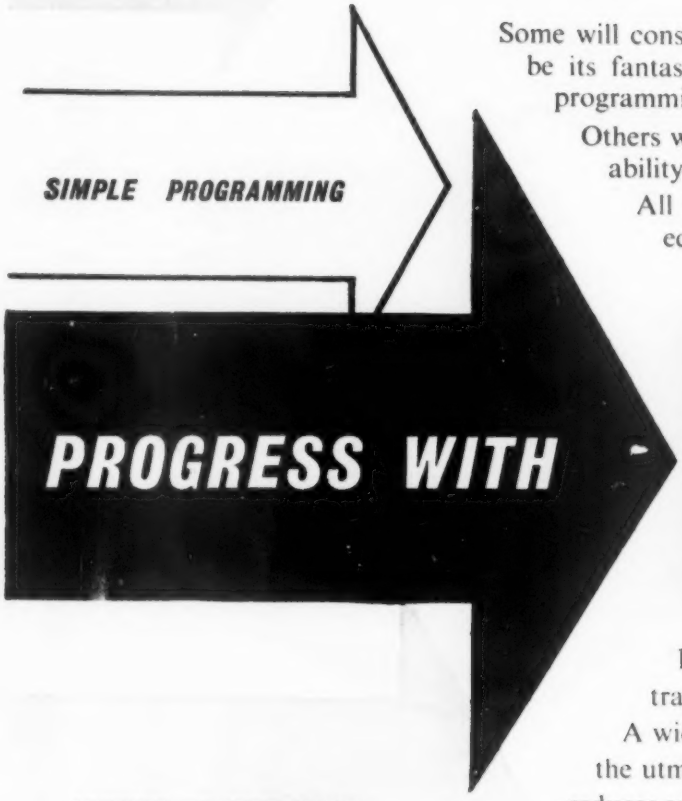

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In the background: PEGASUS. By courtesy of **Ferranti Ltd.**

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PLANNING AND PRACTICE—10

How to Run the Computer Department

Organising the work is a prerequisite to getting the most out of a computer: whether an installation pays its way may hang on this one factor

P M Bridgman, *Unwick Diebold*

THE operation of a computer centre is basically similar to that of any other production plant. Raw material—data for input—is received, and its receipt must be controlled and progressed, the plant has to be loaded with work in time to produce the various products—the business documents such as invoices and partly processed information for other operations — by established delivery dates. In terms of function there will always be three main sections to a computer department—

1—The computer with its peripheral equipment.
2—Data preparation section.
3—Systems analysis and programming section.

The computer room and the data preparation section are concerned with achieving a high output per machine hour and the highest possible machine utilisation. The systems analysis and programming section is engaged primarily on a management service, with the emphasis on carrying out an agreed timetable with a maximum of effective output per man hour. The overall object of the department is to use its highly skilled staff and expensive equipment on the most fruitful applications.

Operation of business and technical applications

Business applications are repetitive, the same routines being operated every day, week, or month depending on their purpose, and they can be likened in the production analogy to orders for stock. By contrast, technical applications tend to be on-off jobs, and consequently business and technical applications have different effects on the computer operation. Business applications frequently require long runs and consequently have to be tightly scheduled in a daily or weekly cycle. When a computer is mainly loaded with business routines the time taken for de-bugging and program testing is likely to be small in relation to the production time, except when new installations are being planned or when large new applications

are being programmed. The systems analysis and programming section of the computer department are generally responsible for business programs.

Technical operations consist mainly of short programs to solve specific problems although there are important exceptional cases where programs take long periods to develop and many hours to run. These programs are initiated by technical specialists usually at fairly short notice and unlike business routines there is no need for long term planning or decisions on priorities.

The relationships of the staff responsible for mathematical services with, on the one hand the technical staff and on the other the computer operating staff, call for some ingenuity in defining the lines of responsibility if the technical staff are to be given the service they require, and if the computing runs are to be fitted conveniently into the computer operating time schedule. If the programmers in the computer section are to be responsible for writing technical programs there is the further problem of ensuring that technical staff specify their requirements in a form the programmers can understand.

In practice, technical staff and their mathematical supporting group frequently write their own programs and often stand by the computer during operation. Where these arrangements apply, the responsibility of the computer department is limited to providing the required hours of computer time. It is desirable, even when a considerable proportion of computer time is allocated to the work of technical departments, that a tight operating schedule is maintained. With a high incidence of technical work new routines are a much larger element, in fewer cases are runs repetitive and more time is required for de-bugging and program testing. Here, however, we are primarily concerned with the operation of business routines.

PREPARING A COMPUTER SCHEDULE

SOME FACTORS TO CONSIDER—

De-bugging

Detailed forward planning of time for de-bugging by project or program is not practical, and usually has to be covered by making an overall allowance for the month and allocating time specifically as demand arises. The aim should be to use slack periods for de-bugging and program testing but to advise programmers in advance of the time allocated so that they can plan their work to make full use of it.

Phasing with Non-Computer Work

As in a production plant each machine operation is dependent upon the previous part of the routine having been completed. Input must be prepared from data flowing into the system unless it arises from the output of previous routines. Queries have to be cleared and so time has to be allowed for this or else the queried data has to be held back for a subsequent cycle of operation, eg. until the next day's run. Magnetic tape and card files must be available and in an off-line printing operation a tape cannot be used on the printer at the same time as it is being used on the computer. And if only one tape is used for all the output printing cannot start until computing is completed. The scheduled work has to be progressed to see that the required input data passes through the preceding stages to be ready for the computer at the time scheduled for commencing the run.

Estimates of Run Times

If computer time is to be allocated correctly, the length of each run must be estimated in advance. Estimated times will include the set-up time and a standard allowance for changing tapes and stationery during the run. In certain ADP applications the files gradually increase in length through the year and a corresponding increase in tape running times must be allowed for.

Equipment Efficiency

In keeping with most other machines and plants, computers never operate at 100 percent efficiency. A schedule which loaded the equipment up to 100 percent would not be met, undertakings to have results ready by certain times would not be kept, and time would be wasted in re-scheduling. Experience of the installation will show the level of efficiency which can be used for loading but until there is enough experience to indicate this level, 75 percent loading of time available after the scheduled maintenance period should be a safe figure to use. Use in this way of the loading figure achieved in practice does not imply that it should be accepted as a standard of performance. The exercise of comparing the cost of raising the loading factor with the benefits to be obtained from it are as applicable to computers as to other units of plant. Some installations claim a consistently better performance than the figure quoted and most installations have periods when a higher standard is achieved.

Work should always be Scheduled

Even if the available work load is only two or three hours a day it should still be scheduled in detail and subsequently performance should be checked against the schedule. Failure to exercise this control can lead to the computer operation being regarded as a research and development project rather than a production operation, and difficulties can arise later when the work increases and production methods have to be introduced to cope with the load.

Machine operations

In many cases computers are supported by punched card equipment including punches and verifiers, sorters, interpreters, collators and tabulators. In such installations it is quite likely that the punched card equipment will be occupied for part of its time on operations that do not involve the use of the computer. Loading of the machines needs to be planned as a whole to include both the operations which use the computer and those which do not.

Machine scheduling

Allocating time on machines for operating the different programs and routines is the responsibility of the senior operator who reports to the manager of the computer department. Scheduling should be in weeks for about a month forward, provision being made for revising the schedule for changes in priorities, re-runs and breakdowns.

In preparing a computer schedule there are many factors to be considered. Some of these are given in the accompanying box on page 15.

Operating the computer

The senior operator should be responsible for seeing that the jobs are run according to the schedule. A run book containing the operating instructions for each run should be kept in the computer room. Control of the runs should be based on a production or job order issued for each run and the document can also serve as a routing slip for the work flow. The use of order forms for large daily jobs might prove cumbersome in practice but the individual forms could be replaced by a standing order to avoid the necessity to issue separate pieces of paper. A specimen form of production order (Form D) is shown on page 16.

Before running any application the operator needs to have:

1. The program.
2. The complete and correct input.
3. Tapes and/or card files.
4. Computer operating instructions specifying the program, the input tapes and the card files to be used.

Form H (on page 17) is an example of a set of computer operating instructions. The instructions are specified by the programmer at the time the program is written and they really form a part of the program.

The operators' work

Responsibility for progressing the work forward to the computer and assembling the data ready to commence the runs usually belongs to

the operators or perhaps to the control clerk.

Once the run is set up the operator has essentially a watching brief. He must be on hand to deal with any exceptional circumstances which may arise during the operation but most of the likely situations will have been anticipated by the programmer and the computer operating instructions will indicate the action to be taken. When the operator is responsible for de-bugging and testing programs he should be provided with details of the information required by the programmer if the program fails.

Part of the operator's function is to determine whether a program failure has been caused by a fault in the program or by a machine fault so that he can decide whether to call for the programmer or for the engineer. In some cases it is most difficult to determine the source of the failure, and it may not be possible to find the answer until both the programmer and the engineer have spent some time in diagnosing the trouble.

The operator should keep a log recording the times of loading and unloading different applications, and of starting and completing scheduled maintenance. An entry must be made in the log

for every interruption that occurs in processing and the causes of interruption must be classified. Where re-runs are required a report should be prepared on why the re-run was necessary and a record and report should also be made if the actual running time exceeds the specified time by more than a small margin. Production orders for completed runs should be filed to provide a record of the run. Notes of unusual occurrences during the run should also be noted on the order forms.

Operators may have to intervene in programs while they are being run and most computers have a control feature on the console for this purpose. This facility is sometimes used for directing the program through special procedures such as month-end routines or the printing of additional control data. It is desirable to minimise the use of manual entry as it can be a source of errors in the routine. When action by the operator is required the operation should be simple and should be fully explained in the run book.

Full instructions should also be given to the operator about re-starting a run after an interruption has occurred. The procedure can involve complicated re-positioning of magnetic tapes, re-loading of input cards and re-positioning of stationery in the printer.

Systems analysis and programming

Systems analysis and programming are often regarded as pre-installation activities, but although they are somewhat reduced when the equipment is installed and operating, they still remain an important part of the operation. Additional applications require to be analysed, and then programs written for them; also existing programs have to be revised. The priority for instigating new applications and revising existing ones is a matter for general management decisions, and should be planned well ahead of the studies being started. Once it is decided to undertake the study and programming of a new application, the work should be planned in detail and target dates established. Progress of the work should regularly be related to the targets set in the same way as when the installation of the computer is planned.

Computer time for de-bugging and program testing should be carefully controlled to avoid excessive use of machine time. Manual checks for coding errors should be made before machine testing. Each program testing run should be originated by a production order stating the purpose of the test and the results required. The results achieved should be noted on the order, a copy being returned to the programmer and the original filed. *Inspection from time to time of the filed copies of production orders for program tests, with the comments recorded on them, provides a check on the quality of programming work produced.*

Effective supervision of machine operation is crucial if the computer project is to be successful. The best systems design and data processing concepts are of no avail if the computer is not operated effectively. From this it is possible to generalise: successful computer operation requires, first, the establishment of a set of simple rules for operating; and, secondly, adequate management to see the rules are applied.

Take a mathematical technique, add a computer and you have the means to work out rapidly when to buy and how to mix the ingredients that go up to make animal feedstuffs

Animal Recipes by Computer

Laura Tatham

SOUND knowledge of the trade, experience, and that indefinable ability labelled 'a nose for the market' are basic qualifications for the successful buyer of the grains and other materials which make up animal feeds. Indispensable though these human abilities are, the experience of Crosfields and Calthrop Ltd, cattle feed manufacturers of Liverpool, has shown unmistakably the usefulness of supplementing them by linear programming on an electronic computer.

Crosfields and Calthrop, who have been in the cattle feed business for 50 years, are a medium-sized public company. They employ a total of about 1,500 workers in factories at Liverpool, London, Bristol and Glasgow.

At any one time about half their employed capital of £2,500,000 is likely to be tied up in inventory: the nature of their business, uncertainty of raw material supplies, and other factors make it necessary for them to hold several weeks' stock of raw materials to ensure that their factories run smoothly.

The computer has helped towards simplifying the buying problem: for example, by considering each material in a recipe in relation to others it has indicated that it is not always necessary to buy materials at the most favourable prices to secure maximum economy of production. When the full program is under way, it will provide buyers with a daily guide of *what* to buy, according to availability and price.

Yet both these important functions are, in a sense, a by-product of the computer's main task: to evolve recipes which simultaneously conform to nutritional and technical requirements and are the most economical.

Four factors must be considered in devising recipes for cattle feed: nutritional value, which must meet rigid specifications set by the company's own standards; palatability; texture, which is an aspect of palatability but also an important factor in machine usage; and last—but by no means least—economy.

To fulfil all these specifications, the manufacturer must juggle dextrously with his materials to maintain a balance between sweetness and sourness, wetness and dryness, smoothness and grittiness, minimum and excess content of certain nutritional elements. At the same time, he must keep one eye anxiously swivelling on current grain market prices, shipping strikes and other factors which may affect raw material supply.

The complications do not end here. A foodstuff might contain, say x percent content of phosphorus. A cow might be able to assimilate the whole of this percentage; but a hog might only be able to utilise 35 percent of this. Again, a recipe used one week might involve a material in which a sudden sharp price rise occurred. Another, or possibly two others, must, if possible, be substituted.

Basically, as can be appreciated from this out-

line, the finding of a successful recipe is based on permutations. Crosfields and Calthrop currently use about 80 different recipes, some of which are made up in more than one form—pellets and meal, for example.

Neat lists produced swiftly

An electronic computer is ideal for coping with a problem of these dimensions. Fed with the basic facts, it can produce, in the form of neat lists, all the recipes required and in accordance with all the specifications, including, of course, the price factor. This job it does in a few hours, as against the two or three weeks it would take a mathematician. The time factor is, of course, of utmost importance, since the results produced by the mathematician would, at best, only act as a rough guide, being hopelessly outdated by the time they were available.

The list of raw materials runs into about 85 to 100 items. These include cereals, by-products of cereals, vegetable proteins (groundnuts, cotton cake and soya, for instance), animal proteins (derived from whale meat, white fish, herring meal, etc), milk products (whey, skim milk) and minerals such as phosphorus. In addition, an ingredient known as 'concentrates' goes into each feed. This is a mixed bag of small quantities of various substances, such as antibiotics, vitamins, trace elements and amino acids, provided in 'package' form by the company's own laboratory.

The basic facts for the computer are prepared in the following way. For each recipe, a list is made of all possible ingredients. Against each ingredient is the maximum and minimum permissible content (expressed as a percentage) and the price; and each ingredient is analysed under various heads such as starch, oil, protein, fibre, amino acids and so forth. These statistics are punched into cards.

Results from equations

The problem is set up in the form of an equation, whereby, for example, the element of protein in each material must be at least equal to a minimum percentage of the total ration. This equation is applied to all the other elements such as protein, oil, etc. For materials such as calcium and phosphorus, however, not only must there be a minimum content, but this total must be restricted. A surplus might have a detrimental effect on the livestock.

The equation must also provide for changes due to the supply position and milling requirements. For example, barley might, in a certain ration, be limited to 20 percent on account of shortage or high price, or molasses content kept low to avoid milling difficulties.

From these basic facts, the computer evolves a mix to meet the specifications provided and at lowest cost. The items are listed on the printer in terms of percentages of the whole.

Other useful facts are also thrown up by the machine. If certain materials have not been selected or are limited in content, the computer indicates the value at which it would have chosen them. It might, for example, in recipe 'A' list barley and quote a price of £x per ton. This indicates that if barley falls to £x per ton, it would be worthwhile purchasing it.

The computer can also assess an economic price for a material which may not, at the time of the calculations, be available. To arrive at a figure like this, the programmer feeds into the computer a price which is so high as to be excluded automatically from any recipe—say £100 per ton. From this, the computer works out a reasonable figure, giving a result expressed in terms of how much would have to be deducted from this absurd figure to make incorporation of the ingredient a practical possibility. In the example chosen it might, for example, show that a reduction of £70 per ton was needed, thus indicating to the company that a price of £30 per ton would make incorporation of this ingredient worthwhile.

Difficulty experienced

Having worked out the mix, the computer also gives a factor indicating the difficulty it experienced in meeting each nutritional requirement—eg. oil or energy value. This shows which element was most costly to obtain. Information like this provides a useful 'feedback' to the company's nutritional experts, who can be asked whether this costly element need be used or whether another (or a combination of others) would do equally well.

Crosfields and Calthrop progressed to their own computer after experience on a service basis at the ICT Computer Centre at London. Work done there convinced them that a computer of their own would be a good investment. Their own 1202 (the same machine as they used at the centre) will be installed shortly.

It is interesting that this company's installation is primarily intended for linear programming only, and will justify its existence on this application alone. The company already have a punched card installation which effectively deals with routine accounting and payroll. Eventually, the 1202 will absorb the work at present done on the electro-mechanical punched card system.

Epidemic at the Chemists

Boots Pure Drug have now begun to do a little 'merchandise accounting' on a computer: what does this mean?

ON 20 April this year Boots Pure Drug Co Ltd took delivery of an Emidec 1100 computer, got it to work by 5 September, and early last month invited journalists to Nottingham to hear what the machine would do—if not 'was doing'—for the company: Boots' managing director welcomed the journalists and hoped that when they came to what one of his cleaners called 'the Epidemic' they would find it interesting.

They do. Admittedly, one would expect a large company like Boots—its 1,300 retail stores ring up over 80 million pounds a year—to be ripe for a computer. What is unusual about Boots—and therefore interesting—is that they were groping back as far as 1954 for means to automate their clerical tasks, and that they are in the retail business, and the first in this field—not usually associated with efficient systems—to introduce a computer, and therefore to overcome *some* of the problems retailers see as being peculiar to their trade. Also they have not been too shy to explain what they were about, which again is exceptional in the very shy retail world.

In essence, the story which the journalists brought back from their Nottingham expedition is not new. It was published last year* when Mr J G Thompson, Boots' computer department manager, wrote an account of how the company proposed to undertake what he called 'comprehensive merchandise accounting'.

* See AUTOMATIC DATA PROCESSING July 1959

Still, the essentials of this 'merchandise accounting' system are worth recapitulating. They provide insight into the 'retail problem,' and illustrate one approach to it, quite apart from giving an idea of what Boots stand to gain from their £203,000 investment in a data processing installation.

Log book for 60,000

Boots supply their stores with some 60,000 lines—though not every store carries the full range—and these are stocked in five warehouses. Daily, orders arrive from the branches, and there is then the task of registering orders, sorting them, making out invoices and despatch notes, and keeping records of all stock transactions—which is to be taken over by the computer system.

In common with most retailers, Boots work on the principle that when an item is sold in a store it should be replaced as soon as possible. Hence the operations that have to be performed between the time a branch orders and the moment it takes delivery of its order must be executed swiftly. These operations are of two types: the actual selecting of goods from the warehouse and their distribution; and the associated paperwork, which is always time-consuming.

Boots propose to use the computer (and its storage capacity) as a gigantic log book for all the 60,000 lines carried, and to make adjustments

to the log as goods are added or removed from the warehouse.

Thus when a branch order is fed to the machine it will:

1—Sort out the items of the order into the sequence they will be picked up in the warehouse.

2—Make adjustments to the totals of stocks held.

3—Print out an extended invoice for the branch to be despatched with the goods.

Additionally out of stock items ordered will be 'remembered' and supplied automatically as soon as the goods are once again in stock.

This procedure will speed up the paperwork side of the operations. In fact, orders for photographic materials from the branches are currently handled on the computer. Eventually, all the lines will be handled on the computer in this way, but this will not happen for many months.

Orders by pencil marks

One remarkable breakthrough that Boots have achieved with their ordering procedure is to have devised an order-document which can be fed almost directly into the computer, cutting out completely the need to prepare punched cards from handwritten orders. For fast moving lines Boots have devised an order card which need only be marked with a pencil on a number of lines to order several products. Marked cards are then mailed to the Nottingham headquarters where they are put through mark sensing punches which convert the cards into special punched cards. (See illustration below.)

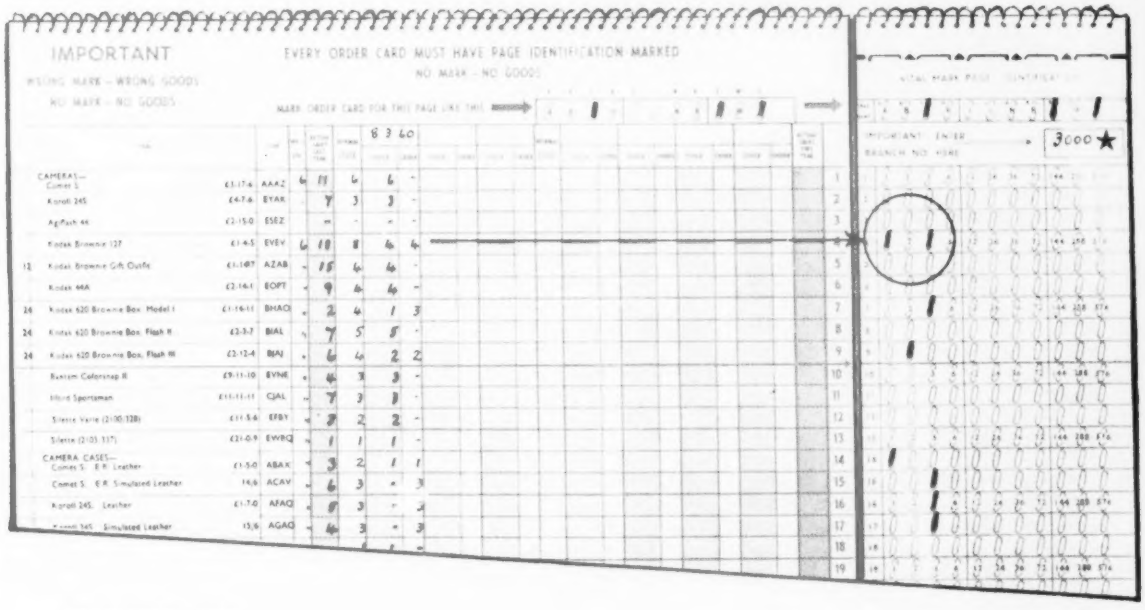
However, processing branch orders is only a part of the task Boots intend to do on their machine. Using the Emidec as a log book for stocks will mean, of course, that they will have permanently up-to-date inventory figures, which can be used for analyses and calculations quite impracticable with conventional methods. As Boots put it:

> 'This (will mean) that information about the flow of goods to branches can be provided in the different forms necessary for a whole host of decisions which formerly had to be based on something very near to guesswork. The result will be closer and more detailed reading of the ups and downs of public demand, taking into account variations too swift and too minute to have been measured before, and the possibility of entirely new thinking in the planning of buying and production.'

How precisely information in the log book will be analysed is not clear, but Boots give a few indications of their thinking:

—it may be possible to confirm or dispel once and for all the suspicion that, for example, certain lines need only be stocked in the Scottish warehouse, or that others need only be called upon three months in the year.

For fast moving lines a card order book is used. On the left are the lines sold—preprinted; on the right a blank card. After identifying the order book page on the card, the assistant has merely to mark in the quantities of each line required.


IMPORTANT
EVERY ORDER CARD MUST HAVE PAGE IDENTIFICATION MARKED
NO MARK — NO GOODS
WRONG MARK — WRONG GOODS
NO MARK — NO GOODS
MARK ORDER CARD FOR THIS PAGE LIKE THIS
8 3 60
3000

Left, one of the printers which produce invoices and despatch notes. Right, J G Thompson, computer department manager.

it may be feasible to undertake *regional merchandising* such as automatically distributing to branches in, for example, the Southern Television area a product being tested there.

where orders from branches fall into a pattern, it may be possible to make regular re-ordering of many classes of goods completely automatic not dependent on branch managers.

Thus keeping inventory records on Emidec would not merely serve to facilitate order-handling and keeping stocks to economic levels (and all the other tricks of minimum re-order levels, etc that can be played by putting stock records onto magnetic tape), but it would be the key to *controlling sales*.

Flashback to 1958

In November 1958 when Boots first announced that they had ordered an Emidec 1100, they released the news at the same time that they would instal an electronic reading automaton (ERA) which would scan cash register tally rolls and thus give headquarters the means to analyse the takings in the stores.

The ERA machine, developed by Solartron, was to be linked up to a 'sales analyser'—a specially-built computer, which Elliott Brothers undertook to construct. An order for 1,000 specially adapted cash registers whose tally rolls could be read by ERA was placed with Regna Cash Register Machines, and it was stated that 5,000 would eventually be required to equip all the stores.

A report in *Scope Magazine* (December 1958) stated that the ERA machine would be delivered in February 1959, after it had been 'married' to the sales analyser. By the time ERA and the new cash registers were operative throughout the organisation, they would have cost Boots about £1 million.

The ERA system was destined to replace 'current hand accounting' whereby the analyses of cash receipts could take weeks to produce; it was to scan till rolls which would contain only the price of the goods sold, their broad classification, and the designation of the assistant who made the sale. The scanned information would be fed to the sales analyser which would 'enable management to have a rapid breakdown of the figures they need.'

In the event the ERA system was not delivered in February 1959; a reader has been duly married to Elliott's sales analyser and the complete system is now working in Solartron's Farnborough factory.

Although announced simultaneously in 1958, the Emidec and the ERA projects in no way linked up. At the time it was stated a 'desirable development' would be the linking of the computer with the electronic scanning system—if each item sold in a store could be recorded in code on the cash register, the actual sales record could be used as the means of re-ordering the product. This was stated to be technically possible but not practicable—it would entail coding every one of 60,000 lines individually.

Re-ordering products is at present initiated by each branch, though Boots, as was mentioned above, foresee that it might be possible to undertake regional merchandising, such as *automatically distributing* to branches a certain area, or, where orders from branches fall into a pattern, it might be possible to make regular re-ordering of many classes of goods *completely automatic*.

If this is the case—if Boots can from inventory records held in their computer system instigate automatic distribution, then obviously the Emidec system will be providing Boots' management with sales control information, and it begins to look as if the ERA system will become expendable.

These Firms Tabulate

Keith Bean

Can a small firm justify and find use for a tabulator and associated card equipment? Our correspondent questioned a number of small companies to find the answer

EFFICIENCY, and the need for it, know no boundaries. It is essential to the prosperity of the small man as much as to the multi-million-pound corporation. Or, to put it more positively, it can be the first step in the change from little-man status to the big time.

That is why it is hard to understand how so many small firms are reluctant or frightened to mechanise their data processing—or just too sleepy to correct their ignorance of the advantages it can bring. Far too often the excuse is 'We are too small for that sort of thing.'

And far too often the excuse hides the failure or even the blind refusal to inquire whether modern equipment wouldn't make for better profits and smoother, more prosperous business generally.

Take punch cards, for example. One advertiser, ICT, finds it necessary, even in 1960, to pay money to point out that punch cards are not the prerogative of large firms, and that some users employ as few as a dozen people.

So we went in search of small firms who use punch card equipment to discover how they used it and what they thought of it. We didn't find a 12-man firm, but we found one—Chadwicks (Dublin) Ltd—with only four employees engaged in office routine work and another, G H Bloore Ltd, which has a total of only 27 employees in all. We found others, too, somewhat larger but still classifiable as 'small users.'

What equipment do they buy and what is their approach to it?

Chadwicks

In business as builders' merchants for 50 years, Chadwicks had a built-in dislike of any radical change of procedure and shied away from the idea of punch card accounting when it was put to them in 1955. The usual objection that they were small was true enough, even by Ireland's standards, since they had only 72 employees with only four on office routine work. Besides, they argued, the building industry in Ireland always seems to be travelling between major slump and minor boom, apart from the seasonal nature of the trade.

But they thought the thing through and this is what Mr W F McEvoy, their accountant, has to tell:

'We came to the conclusion that the smaller the business, the greater the need for efficiency if we were to maintain our share in the industry in competition with the giants. We were also influenced by the fact that the very nature of our trade called for a variety of detailed analyses since total figures only were capable of leading management to entirely wrong conclusions.

'The merits of punch cards for analysis work were evident to us but the cost of the installation for that purpose alone did not seem justifiable. It was at that stage that our minds turned to the acceptance of the idea that our everyday routine accounting could be combined with our statistical requirements.'

They ironed out a scheme with ICT to meet these requirements and provide for future expansion and they rented a set of 21-column machines—two automatic key punches, sorter and tabulator. Staff training was also undertaken with ICT co-operation.

'Within about four weeks two of our staff had reached a degree of efficiency that enabled us to start producing our debtors' ledger and customers' statements,' says McEvoy. 'A month later we had our creditors' ledger and suppliers' remittance advices produced for us on the machines. Within another four months the full program of accounting and analysis was being produced on punch cards. . . .'

Today the main work of this installation comprises:

1. Sales. Tabulation of daily sales invoice totals in numerical order.
   Analysis by department, customer and traveller.
   Analysis of sales at cost by department, customer and traveller.
   Debtors' ledger and customers' monthly statements.

2. Purchases. Departmental analysis of purchase invoices.
   Creditors' ledger and remittance advices.
3. Wages. Departmental analysis, the totals being available for WCA and income tax returns.
4. Costings. Tabulations showing the operation cost and earnings of each of the company's vehicles.
5. Stock control. Quantity control on cement tonnage, gallons of petrol, diesel oil, etc.

The decisive factor in the Chadwick decision to mechanise—the need for speedy analysis—is characteristic. Although there are cases where the main object in introducing the machines has been direct economy they are rare. More usually additional information, higher productivity and simply higher speeds are the instigating factors.

In the economics of such installations there is no formula that can be applied universally. Assessing the cost of running an existing installation is easy enough, given the sort of workmanlike approach outlined in the July issue of AUTOMATIC DATA PROCESSING,* but again each must be done individually and the figures are no guide for future use as conditions vary so much.

Take punching cards, for instance. There are installations where the labour cost of punching 1000 cards is about four shillings and there are others where it may be 40 shillings.

A very simple small card installation can be obtained for about £5,000 and this could be run by three or four operators at £7 or £8 a week but to equate this against the value of clerical work which they could take over is impossible without knowing the details of the individual case.

The machines, of course, can do so much more work, as Mr B Battall, secretary of G H Bloore Ltd, testifies.

'It is very difficult to arrive at any sort of comparative costs for previous methods against punch cards as the volume of work done has increased so rapidly,' he says, 'and also the amount of analysis work that we do just could not be considered by any other means than punch cards.'

Bloore's

Bloore's (Manchester), stockists and distributors of plastic materials, have a 21-column tabulator, sorter and automatic punch. Previously their ledgers were done on a keyboard accounting machine with normal ledger cards and analysis was done by hand.

Now the punch card work comprises sales ledger, purchases ledger, detailed analysis of sales by type of user, area and type of material, analysis of purchases by type of material and analysis of overhead expenses for posting to the nominal ledger.

'We did originally attempt a stock control by punch cards,' said Battall, 'but we found it unsatisfactory because our stock comprises such a vast variety of types, colours and sizes of material that it proved too complicated.

'Our sales ledger has a total of approximately 3,000 accounts and we send out about 1,500 statements a month. The ledger is kept on the open item method which has the great advantage of showing on the statement exactly which items remain unpaid, which greatly facilitates the checking of overdue accounts.

'The greatest disadvantage is that as the ledger is only posted at the end of each month when statements are prepared it is extremely difficult to know the state of any individual account during the course of the month.'

Allied Libraries

Like Bloore's, Allied Libraries Ltd, wholesalers of books, stationery and gramophone records, used accounting machines. Last year they installed 21-column card equipment and do all their ledger work except payroll on it. They have 100 employees.

Owing to rapidly expanding business they too find it difficult to compare the costs of the new system with the old, although they make the point that stationery, provided it is bought in reasonable quantities, is cheaper.

'It takes longer to prepare data (invoices, etc) for the new machines,' said Mr G D Fairley, a director of the firm, 'but there is considerable time-saving in the production of the final document—ledger, statement, analysis of sales and so on.'

Abrasive Manufacturing

Abrasive Manufacturing Company Ltd makes good use of the small punch card installation for labour accounting. It employs 200 people making carborundum grinding wheels and the like, and has one hand-operated key punch, one sorter and a 21-column tabulator.

From job cards issued to the factory, cards are punched, sorted and tabulated to produce the payroll. As there is no verifier in the installation the payroll is called back to the original job cards and in this way verification is established.

This installation is operated by one operator and the complete payroll is produced as the result of one afternoon's work.

These, then, are some examples of the routines which punch card data processing undertakes for 'small users.' Nobody expects highly sophisticated procedures from such equipment but enough has been said to indicate its value in giving accurate accounting, statistical information and analysis.

* See page 17, *How to run a punched card department.*

from John Diebold and Associates, New York

The ADP experience of local and state governments

Parish pump government is getting in on the act—ordering data processing systems for clerical chores, instead of considering computers as merely for the engineer's problems

THE United States government, taken collectively, is unquestionably the world's largest user of automatic data processing equipment. Furthermore, the various departments that comprise the government have to a significant extent been the pioneers in effective ADP applications for a variety of 'business data processing' purposes. This relatively good performance and sophistication holds true even if one excludes the Department of Defense activities, although even at the federal level a great deal needs to be done to capitalise fully on ADP's potential.

In contrast to the good progress made at the federal level, the use of automatic data processing on the state, city, and local level is just in its infancy, and yet cities and states, and even some communities, have data processing problems that are as complex, and that require as much clerical labour, as industrial and business applications.

There are many reasons for this lagging, but this has been arrested and there will probably be a significant growth in the use of computers by public organisations. First, needs have increased as suburbs have grown, and areas covered by a given administrative organisation have increased. A further impetus is the growing prosperity of many communities: it is not only that there is more money to spend on computers, but as more individuals buy houses, as automobile registrations increase, as new public undertakings are started, the need for better ways of handling the work coincides with the greater availability of funds.

One example or indication of the growing interest is the proportion of machines on order to those installed for non-federal government agencies. There are about 130 computers installed and an equal or slightly higher number on order, according to a recent census of this field by John Diebold and Associates.

This comparison between machines installed and on order shows that over the next 18 months there will be more than 100 percent increase in

applications in the state and local government area, and this pace is likely to be accelerated in the future.

Especially significant is that a large proportion of the new machines will be used for business-type data processing rather than for engineering calculations. This increase of activity can be attributed to better 'know-how' in using computers, but there is little doubt that the main reason is the availability of lower priced, more versatile computers.

ADP in State and Local Government

Punched card tabulating systems for government expanded greatly after the War, but electronics did not develop until the impact of the Federal Highway Programme, in which the federal government provided major financial assistance to states for building highways. The first computers were thus used for highway engineering calculations (cut and fill calculations, bridge design, etc). During the 1955-57 period, over twenty-five IBM 650's were installed for these purposes. Even where idle machine time developed, it was not used for business type data processing, although several states got into data processing in this manner. California is one example, a state that also pioneered the use of an IBM 702 in the State Department of Employment Security.

Cities and counties tended to lag behind even the states in the application of computers. In the first place, the early systems were fairly large and expensive, and could therefore not be justified. In addition, political factors had to be overcome, and it had to be shown that tabulating equipment could not handle the work as well, a task that was made more difficult by the relatively low pay scales of some municipal and county governments, as well as the reluctance to reduce employment among a group that votes, and whose relatives vote.

A major break-through in municipal automatic data processing was the installation of a medium scale computer in the City of Detroit in 1956. Payroll was the first application, but since then other uses have been developed: budget accounting, construction calculations, tax billing, calculations for the electricity flow system and for the Water Department, as well as a great variety of statistical reports.

Extent of usage

The most recent survey made by John Diebold and Associates indicates 128 computers installed. Of these, 99 are in state governments, 13 in cities, and 16 in county governments. Four are large scale machines, though only one large scale computer is used by a city (New York). In accordance with the development of applications, it is significant that 39 out of the 128 computers are small scale machines used primarily for engineering calculations, while an additional 30 to 35 of the machines are on the border line between small and medium scale and are used largely for engineering calculations and mixed business–engineering purposes.

At the present time, the computer time utilisation divides itself fairly equally between engineering and business applications. In 1955-1956, the proportion was about 80-20 in favour of engineering uses, and in the near future, based on existing plans, the ratio will soon be 80-20 in favour of data processing applications. Most of the systems on order are of the small scale business data processing type, and there seems to be relatively little tendency to develop one overall data processing centre for a state, or even for smaller administrative units. This tendency is borne out by the fact that individual departments will each order their own equipment, and at times there is no one person or organisation in the government aware of the data processing plans of the organism as a whole.

As this type of an approach results in the kinds of difficulties that have already been experienced by business users that started in the same way, there may be a reversal, but for the time being it seems to be a case of each agency for itself. *This is constructive, however, in so far as it prevents the long delays that so often result when too many people have to participate in the decision. It also prevents the combination of operations that have no logical relationship to each other.*

The profitable applications vary from one location to another, but the most common ones (either planned or in actual operation) are the following:

1 For states:

Personnel retirement
Revenue accounting
Employment security
Public Assistance
Public Health statistics
Motor Vehicle registrations and statistics
Alcoholic Beverage Control
Highway Construction
Finance and Budgeting

2 For cities:

Real Estate Taxation
Appropriations Accounting
Budgetary Control
Public Works
Public assistance
Police work
Voter Registration.

Applications and Installations

The best way to see what is being done in government with computers, and also to get an idea of the developments to be expected on a broader scale, is to look at some of the specific accomplishments in the field. In the first place, the Highway Department of every state has a computer for its road building calculations. Other, business type applications also occasionally concern themselves with roads. For instance, the State of Illinois has a medium scale computer to process drivers' licences and the related records. Many turnpike or toll road authorities are slowly moving from the punched card tabulating to computers, but these are independent agencies that, in the USA, do not fall into the state or local government category.

One of the most interesting examples of centralised processing is perhaps the large scale computer that has been used by the government of Puerto Rico for a whole variety of applications. Its first work is payroll, and it will gradually extend to a whole range of government accounting operations: tax records, stores and inventory, demography, and police statistics. In Pennsylvania there is a computer that has also started on payroll, although this particular case has met with several difficulties that have slowed its rate of progress. The city of Los Angeles is handling its school payroll on a computer, while small random access machines seem popular for certain counties in their budgeting and financial accounting work. Ventura County, California; Dade County, Florida; Rochester's Monroe County in New York; and Fulton, Alabama, have all taken steps to attack their growing administration and paperwork problems with computers. The City of New Haven, Connecticut, is an example of a small to medium size city that has found it profitable to apply a computer to its financial accounting activities. The work of the computer is to help the fiscal officer keep track of expenditures and relate them to the budget that has been approved by the legislature. This is accomplished through a random access machine that permits the immediate updating of budget and expenditure records as the transactions occur.

The largest municipal computer activity is taking place in New York City. There, one large scale computer handles centrally a payroll of 160,000 city employees, and takes care of a variety of related applications such as pensions. This machine is in the Comptroller's Department, and there are plans to shift from the present large scale computer to a more 'up to date' transistorised model in the near future. In addition, about a dozen small scale computers for various Comptrollership functions, such as fund accounting, are planned throughout the city. In addition to the computer activities in the Comptroller's Department, a large scale machine has been ordered for the Welfare Department. Its function will be to handle the recipients' budget and to calculate what each welfare recipient should receive and to make the payment, as well as to maintain the subsidiary records. In this rather monolithic installation, five small scale computers will be used in conjunction with the larger one to speed input and output.

Other New York City computer activities involve the Purchasing Department, whose problems have been described as closely resembling those of a business organisation. The small scale computer will be used for controlling the stores in the various city warehouses. In the Department of Education a similar computer has been ordered for the Purchasing Section, while the Department of Buildings will also receive a computer in 1961. Its purpose will be to process complaints and violations of the building code, and to keep up to date and easily accessible records of all violations as well as the results of premises inspections.

Although there are not many cities, or states, with applications as extensive as those of New York City, there are instances of interesting uses of computers in other municipalities, and in associations concerned with municipal and state government.

Transportation Study

The City of Chicago is just completing an Area Transportation Study. It consists of the study of about 10 million individual person trips every weekday, to study origins, destinations, and traffic density to help in the control of traffic and in the construction of future roads and in the conduct of municipal planning. This particular study makes use of a series of special purpose machines that present in simple and summarised form the trip desires and trip patterns. The input to the device is magnetic tape, while the output is a photographic negative that reflects accurately the density of any particular route. Such a precise and thorough study would just not have been possible without the advanced developments that have permitted a reasonable assembly of the input information and a means for translating this input into meaningful results quickly and flexibly.

Local government use of computers has for some time been a relatively neglected area of computer usage, and in many cases the officials have been wise in biding their time. However, in the USA there is a very clear indication that, with new computers available and with a variety of applications tested and proved, there will be a significant increase in operating installations in the next year.

JOB MARKET

Who Wants What?

QUITE often revealing pointers to business activity are to be found in the 'situations vacant' columns of the national newspapers. In fact business expansions may often be reflected in these pages long before Stock Exchange quotations indicate that something is happening.

There are three reasons why companies go into the job market: first, expansion of the business; secondly, where a company's management lack a certain expertise, and this has to be found quickly; and thirdly where a company cannot hold on to staff, it has to make repeated trips to the market to replace executives who have moved on—usually to more lucrative positions.

Also, there are certain firms who wish to put their name before the public but are perhaps inhibited for professional reasons from advertising in the normal way. Consequently, they book prominent spaces in the 'situations vacant' columns, requesting staff but 'incidentally' advertising their services. Nevertheless, the great bulk of advertising for staff is genuine, and in a field like data processing, where installations outrun the people trained to supervise and organise them, demand is keen, and there exists what may be termed as an 'applicants' market'.

During the past three weeks AUTOMATIC DATA PROCESSING has taken a sample of the advertisements to recruit data processing and computer personnel that have appeared in two national newspapers.

A review of these advertisements throws up some enlightening facts:

There were no advertisements for programmers by government departments with the exception of the very specialised field of Atomic Energy; here mathematicians and programmers were canvassed, for a Ferranti Mercury and an AEI PACE (analogue computer) installation, and it was noted in parenthesis that an IBM 1401 was on order.

Consumer industries were represented by Sainsbury's (O and M men to work with Emidec), Carreras Ltd (an O and M assistant to work with punched cards on 1202 computer and 550 calculator) and Radio Rentals (O and M assistant).

Heavy industry provided a few openings: Dowty's needing an O and M man, as did the Cementation Company, whose function was to work in conjunction with a data processing bureau using an electronic calculator. British Oxygen, who were expanding their O and M department, asked for men experienced in carrying out investigations and designing and installing new systems. Park Gate Iron and Steel wanted a program planner for a punched card installation and C and J Clark a man to work with a data processing section using IBM equipment. Norton Grinding Wheel Co required graduates to work on a variety of problems for the installation of a 1301.

The giants, Bowaters, Courtaulds and the NCB required O and M men. In the case of Bowaters one of the men was required to join a computer feasibility study team. Courtaulds further added a dash of sex by requesting women programmers—who, of course, are normally paid less than their male counterparts.

The computer and office machine companies themselves advertised for staff—with ICT the most frequent canvasser. Block and Anderson required people to make a sales career in business automation. Ferranti requested a sales manager for their Scottish Office, and IBM also wanted salesmen—200 of them! EMI wanted electronic design draughtsmen, and Mullard semi-conductor engineers for computers. Plessey wanted sales engineers for its industrial electronics division and Associated Transistors applied for a graduate physicist. AEI-Hotpoint wanted a senior systems analyst. GEC wanted design and development engineers for their computer section. Several US companies advertised for microwave engineers and physicists to work in America.

Salaries were seldom mentioned. A chief programmer requested by Urwick Diebold for an unspecified Orion customer was offered £1,500-£2,000, while Cementation offered £1,500 to their O and M man. The Atomic Energy programmer salaries were to range between £660 (at age of 22) to £2,460; NCB offered a salary range of £780-£1,350 for operational research scientists. Carreras offered a minimum of £950 for the O and M assistant, but gave no ceiling.

Small Computers

This section of the Survey reviews the range of small computers available in Britain, a few of which are special-purpose or 'scientific' machines not designed to do data processing work

E.101—(Maker—Burroughs Adding Machine Ltd)
Size: Small *Price:* £16,400 to £21,000
Applications: Commercial or technical problems too complex for efficient solution on a desk calculator, *eg.* cost distribution, budget analysis, matrix operations, simultaneous equations.
Delivery: As required.

THE entire E.101 is contained in a single unit—a console little larger than a standard office desk, which contains the computing equipment and on which is mounted an 11-column keyboard machine.

In function, the E.101 is not unlike a highly sophisticated desk calculator but with the important additional features of electronic speeds, programmed operation, automatic input and output when required and a 'memory'.

Programming is done by setting pins in removable boards, this job being simplified by using paper templates which indicate settings and provide a permanent program record. The computer provides for 128 program steps and 29 single-address instructions. It operates in decimal notation. A magnetic drum provides storage for 220 words each of 12 decimal digits and mathematical sign.

Data and instructions can be fed in from the keyboard or at a speed of 20 characters per second by a 5- or 8-channel paper tape reader. The same two media are used for output.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 50 milliseconds.
Multiplication & Division: 233 to 433 milliseconds.
Internal Storage:
Magnetic drum. 220 words of 12 digits and sign each.
Input Output External Storage:
Input: Sensimatic-type keyboard. Speed up to 24 characters per second.
Up to 3 paper tape readers; 20 characters per second; 5- or 8-channel code.
Punched cards, one or two input stations. Five program bands control reading sequences. Speed 15 x 80-column cards per minute.
Output: Paper tape punch; 20 characters per second.
Sensimatic-type printer with 18 or 22 inch carriage and program-controlled print format.
Storage: External pinboard programming; 8 pinboards with 16 instructions per board.
Maximum number of input output units: Five.

300 DP—(Maker—De La Rue Bull Machines Ltd)
Size: Small to medium. *Price:* Each unit about £3,500.
Applications: Commercial data processing of all kinds.
Delivery: About 18 months.

THE 300 DP is a system based on conventional Bull punched card machinery. This can be grouped in an almost limitless number of permutations round instruction and co-ordination units which, in turn, may be linked in series. Components are the co-ordinator (program control unit), electro-mechanical or electronic calculators, magnetic drum, magnetic tape units, card readers and reader-punches, and output printers.

A typical small starting installation might comprise four parts—program control unit, calculating unit, card reader, printer. At the other end of the scale, there could be a much more elaborate set-up including two or more control units linked together and each with its own constellation of peripheral equipment.

All machines are synchronised to a common speed. Card reading and punching speed are 300 cards per minute, output printer 300 lines per minute. Each program control unit can govern up to three input-output equipments (in any combination) and has two remaining channels which may be linked to electro-mechanical or electronic calculators (with or without magnetic drums) or to other control units.

The electronic calculator is a plugboard-programmed machine which performs all four arithmetical operations and allows 32 or 64 program steps. Storage capacity of the magnetic drum is up to 16,384 words.

Up to eight magnetic tape units may be used and are controlled by a device built round a ferrite core storage unit.

SPECIFICATIONS

Arithmetic Speeds:
Governed by synchronised action of whole system—300 cycles per minute.

Internal Storage:
Optional magnetic drum unit. Capacity 50,000 to 200,000 decimal digits.
Input/Output/External Storage:
Input: Card reader; 300 x 80-column cards per minute. Card reader-punch; read speed 300 x 80-column cards per minute.
Output: Card reader-punch; punch speed 300 x 80-column cards per minute.
Character printer; 300 x 120-character lines per minute (can function with split carriage).
Storage: Up to 8 magnetic tape units, capacity 3,840,000 decimal digits each. Read speed, 22,500 characters per second. Multi-selector unit which controls magnetic tape units has three blocks of quick-access core storage each holding 192 decimal digits.
Maximum number of input/output units: Each program control unit has 3 input-output channels and 2 channels to connect to other control unit or calculators or multi-selector tape control unit.

GAMMA 3—(Maker—De La Rue Bull Machines Ltd)
Size: Medium. *Price:* £30,000 to £45,000.
Applications: Commercial data processing of all kinds; scientific and technical work.
Delivery: 10 to 12 months.

GAMMA 3 is the nucleus of a computing system in which varying combinations of punched card units may be employed. Designed for flexibility, the system could start with a four-unit basic installation comprising calculating unit, tabulator, reproducer and card read-punch.

Basic internal storage of the arithmetic unit is four words each of 12 decimal digits; this can be increased by stages to give maximum capacity of 31 words. A magnetic drum with a capacity of 191,608 decimal digits can also be added. This apparatus, which has a relatively slow revolution speed is fitted with a buffer store. Effect of this is to speed access to the drum to a rate comparable with that of the arithmetic unit.

Further enlargement can be made by connecting up a control unit which acts as a liaison between the storage and input-output units. With this device, two output tabulators, each simultaneously carrying out printing and card punching operations, can work at the same time on different jobs.

Programming is by plugboard, supplemented by punched cards, each of which accepts 48 program steps. Program capacity may vary from a basic 32 to a maximum of 128 steps.

SPECIFICATIONS

Arithmetic Speeds:
Addition, Subtraction, Multiplication, Division: 1 to 10 milliseconds.
Internal Storage:
Basic store 4 x 12-digit words; can be increased to a total of 7 words, or, by adding extra units, to a maximum total of 31 x 12-digit words.
Magnetic drum; 191,608 decimal digits. Revolution speed, 2,750 per minute; access (with plug-in buffer stores) 0.17 milliseconds.
Input Output External Storage:
Input: Card reader, 150 cards per minute.
Card reader-punch, 150 cards per minute.
Card reader-punch with magnetic reading head (for calculations from data marked on cards).

COURSES AND CONFERENCES

13 November—2 December
Organisation and Methods residential course
Organised by The Institute of Office Management
Fee: £125 (includes accommodation)
Venue: Prince of Wales Hotel, Southport, Lancs.
Enquiries to: The Course Secretary, The Institute of Office Management, 56 Victoria Street, London, SW1.

14 November—17 November
Computer Appreciation course
Organised by International Computers and Tabulators Ltd
Venue: ICT Computer Centre, Putney Bridge House, Putney Bridge Approach, London, SW6.
Enquiries to: The Administrator, ICT Application Training Centres, Moor Hall, Cookham, Berks.

21—25 November
Executive course
Organised by Leo Computer Ltd
Fee: 25 guineas
Venue: Hartree House, 151a-159a Queensway, London, W3.
Enquiries to: J C Jenkins, Esq, Leo Computers Ltd, Hartree House, 151a-159a Queensway, London, W3.

28 November—16 December
Computer course on Emidec 1100
Organised by EMI Electronics Ltd
Fee: 50 guineas
Venue: Hayes, Middx.
Enquiries to: R Johnson, Esq, Publicity Dept, EMI Electronics Ltd, Hayes, Middx.

28 November for two weeks
Computer Appreciation Course
Organised by International Computers & Tabulators Ltd
Venue: ICT Computer Training Centre, Bradenham Manor, Bucks.
Enquiries to: The Administrator, ICT Training Centres, Moor Hall, Cookham, Berks.

12—16 December
Stantec Zebra Programming Course—simple code
Organised by Standard Telephones and Cables Ltd
Venue: Newport, Mon.
Enquiries to: A Y Cooper, Esq, Standard Telephones and Cables Ltd, Corporation Road, Newport, Mon.

12—16 December
Programming course on the 802 and 803 computer
Organised by Elliott Brothers Ltd
Venue: Elliott Brothers Ltd, Computing Division, Elstree Way, Borehamwood, Herts.

Computer manufacturers, universities, colleges and professional organisations are invited to send details of the courses and conferences they organise for inclusion in this diary.

Output: Reproducer, 120 x 160-column cards per minute.
Tabulator, 150 lines per minute.
Card reader-punch (see input).
Control unit, governing two tabulators.
Storage: None.
Maximum number of input/output units: Variable, according to type of installation.

ARGUS—(Maker—Ferranti Ltd)
Size: Small. *Price:* About £30,000 to £70,000.
Applications: Direct control of power plants, steel rolling mills, chemical processes, etc., and associated equipment.
Delivery: About 9 months.

THOUGH a digital computer, Argus is designed entirely for process control. The basic machine comprises two cabinets each five feet high and two feet square with, alongside, a smaller cabinet which supports an electric typewriter connected to the computer for output purposes. All-transistorised and needing only a small power supply, Argus can be moved from place to place.

There are two types of immediate access store. Pegboard trays store program instructions and constants; ferrite cores are used for storage during calculation. Basic capacity of each is extendable, though in each case dimensions of the computer remain unchanged.

Input can be shaft rotations, voltages, pressures, temperatures and so on, and up to several hundred units may be connected. But if very multitudinous, an extra cabinet may be needed. Normally there is electronic switching between input channels, though mechanical switching can be provided.

Output comprises digital signals to operate switches and analogue currents for control purposes. Additional input can be inserted manually by dials and switches or through the typewriter keyboard; the typewriter can also be used for output. Paper tape input and output, though not a standard feature, can be provided. Magnetic drum storage is another optional extra.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 20-40 microseconds.
Multiplication: 100-220 microseconds.
Division: 200-420 microseconds.
Internal Storage:
Pegboards holding program instructions and constants.
Immediate access. 1024, 2048 or 4096 x 24-bit words.
Ferrite core. Immediate access. 1024, 2048 or 3072 x 12-bit words.
Input Output External Storage:
Input: Shaft rotations, analogue voltages and currents, selected and converted to digital form by computer. Electronic or mechanical switching between input channels.
Hand-set dials and switches.
Punched paper tape (optional).
Output: Digital signals.
Analogue signals.
Electric typewriter with 20-inch carriage.
Strip printer (optional).
Paper tape punch (optional).
Magnetic tape (optional).
Storage: Magnetic drum. 50,000 x 12-bit words (optional extra).
Maximum number of input/output units: Almost limitless—*eg.* several hundreds of four or five different types.

SIRIUS—(Maker—Ferranti Ltd)
Size: Small. *Price:* About £17,500.
Applications: Commercial, technical or scientific work. With suitable peripheral equipment the machine can be used for data-logging and process control.
Delivery: Three to five months.

AN all-transistorised machine, Sirius comprises a single narrow cabinet and a desk incorporating a control console. The computer runs from a 230-volt 50-cycle 5-amp. mains supply.

Input is by a transistorised photo-electric paper tape reader with a speed of up to 300 characters per second, which uses 5-channel tape. Output is through a Teletype punch with a speed of 60 characters per second.

Basic storage capacity is 1,000 words of 10 decimal digits, all of which are available for use by the programmer for any purpose. Extra words in plug-in packages of 100 can be added to a total of 3,000.

The computer is designed for extension if required. Additional tape readers and punches can be attached and placed on the desk beside the others. Extra storage units (providing a maximum of 9,000 over the 3,000 mentioned above) and card reader and punch are available in the form of separate free-standing units which can be placed anywhere reasonably close to the computer.

Sirius has eight accumulators in which arithmetic is done. These multiple accumulators simplify and speed program-writing. Contents of any accumulator may be used to 'modify' an instruction, so that repetitive procedures are easily programmed. An accumulator used for modification may also hold a counter for controlling repetitive process. Order code comprises 68 different instructions.

Program library of paper tapes for common routines. System similar to auto-coding permits use of Sirius with little or no help from a trained programmer. Programs typed on teleprinter which simultaneously punches paper tape. Decimal numbers are used.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 240 microseconds to 4 milliseconds.
Multiplication & Division: 4 to 16 milliseconds.
Internal Storage:
Torsional delay lines; 1,000 words of 10 decimal digits each.
10 accumulators (single-word delay lines).
50-word delay line buffer stores are used when punched card equipment is employed.
Input Output/External Storage:
Input: 5-hole paper tape reader; 300 characters per second maximum speed.
Punched card reader; 120 cards per minute.
Output: Paper tape punch; 60 characters per second: or high-speed model; 300 characters per second.
Creed 75 teleprinter (activated by tape); 10 characters per second.
Card punch: 120 cards per minute.
Storage: Up to 3 delay-line cabinets with 3,000 words each.
Maximum number of input/output units: 10 input, 10 output.

609—(Maker—IBM United Kingdom Ltd)
Size: Small. *Price:* £14,000 to £30,000.
Applications: Small commercial data processing systems —*e.g.* payroll, stores, invoicing.
Delivery: As required.

THIS machine is in same group as IBM 604, 626 and 628 and is designed to expand the area of applications performed by these. Transistorised, the 609 occupies a single cabinet and performs basic arithmetic —addition, subtraction, multiplication, division.

Input is by card reader with a speed of 200 per minute. Output data may be punched into the same card from which input is read or into a fresh card, also at 200 cards per minute. For selection of card output there are three stackers.

Operations are controlled from a wired panel. From 16 to 144 program steps are available, may be used in any order and repeated any number of times according to tests made during calculations.

Storage is by magnetic core with an expandable capacity with 12-digit words which can be sub-divided into two equal halves, each with its own sign position, which can be used independently of one another. Data can be put into or taken from storage without passing through an intermediary counter, thus reducing number of program steps required.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 6-digit word, 224 microseconds; 12-digit word, 392 microseconds.
Multiplication: 5-digit multiplier, 8 milliseconds.
Division: 12-digit dividend, 16 milliseconds.
Internal Storage:
Model A: 20 to 32 words of 12 digits each which can be split into two 6-word halves, usable independently and each with own sign.
Model B: 7 to 16 words (details as for Model A).
Direct add-to-storage eliminates counters and reduces program steps.
Input/Output/External Storage:
Input: Card reader. 200 cards per minute.
Output: Card punch. 200 cards per minute.
Storage: None.
Maximum number of input/output units: One of each.

1401—(Maker—IBM United Kingdom Ltd)
Size: Small. *Price:* £50,000 to £100,000.
Applications: Various types of commercial data processing—either as an independent unit or in conjunction with larger systems.
Delivery: As required.

COMPACTNESS is notable feature of 1401. Basic computer comprises only three small units—card read-punch, transistorised processor, high-speed line printer. To these, up to six magnetic tape units can be added, even these occupying little floor space.

Card read-punch, used for input-output, has five stackers; two permanently allocated to reading, two to punching, the fifth assigned to either function as the program dictates.

Operations of processing unit are controlled by sequential stored program, using words of variable length. This arrangement makes best use of magnetic core store. Instructions also are of variable length; many can be accommodated in only one storage position.

Unit handles numeric characters in decimal form; also, equally easily, alphabetic and special characters, only one storage position being needed for each of these. Processor is built on modular basis so that special features and extra control circuits can very easily be added.

Speeds of up to 600 lines per minute are achieved by the output printer which is used alternatively, according to program, with the punching function of the card read-punch. New design principle moves chain of type at high speed across paper.

Special feature of output printer is very high skip speed (unused portions of forms moved at 33 to 75 inches per second). This greatly increases real working speed which, in printers with slower skip, is in practice far lower than theoretical maximum.

Tape units have very high character storage density—well over 10,000,000 characters on one 2,400-foot reel. Tape records can be of any length for which core storage is available, thus giving faster processing and eliminating storage of redundant details.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 8 digits in 0.31 milliseconds.
Multiplication: 6 x 4 digits in 2.4 milliseconds.
Division: Not given.
Internal Storage:
Immediate access magnetic core. Up to 16,000 characters. Variable word length. Add-to-storage arithmetic.
Input/Output/External Storage:
Input: 1402 card read-punch. Reading speed 800 cards per minute.
Output: 1402 card read-punch. Punching speed 250 cards per minute.
1403 printer. 600 lines x 100 or 132 characters per minute. Skipping speed (blank portions of form) up to 75 inches per second.
Storage: Up to six magnetic tape units with choice of two kinds. (1) 2,400 feet, 200 or 556 characters per inch. Transfer speed 15,000 or 41,667 characters per second. (2) 2,400 feet, 200 or 556 characters per inch. Transfer speed 22,500 or 62,500 characters per second.
Maximum number of input/output units: Two.

610—(Maker—IBM United Kingdom Ltd)
Size: Small. *Price:* £21,600.
Applications: Mathematical—*eg.* matrix work, integration of differential equations, stress analysis, data reduction. Can also be used as off-line computer in maker's automatic production recording system; and to check programs on binary computers.
Delivery: As required.

ITS makers call 610 an 'automatic decimal point computer'. This title refers to the facility whereby the operator inserts the decimal point as part of the data and the computer, after each operation, automatically centres the point in the arithmetic unit.

The machine is desk-size. There are four input-output and control units: (1) console keyboard and output typewriter and cathode ray tube. (2) 200-step control panel. (3) Program tape punch and reader. (4) Data tape punch and reader. The keyboard is always in control of the computer until it gives control over to one of the other units.

Program information is entered directly into the 610 via the plugboard, keyboard or punched paper tape (5- or 8-channel). Computation goes on concurrently

with the entry of the data and program. The machine can be used with either decimal or octal numbering systems.

Basic storage is a small magnetic drum with 80 'double length' registers all usable both as storage and counters.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 0.28 seconds.
Multiplication: 1.15 to 1.36 seconds.
Division: 1.15 to 1.43 seconds.
Square root: 1.92 to 2.23 seconds.
Internal Storage:
Magnetic drum with 84 storage or counting registers, each with capacity of mathematical sign 15 digits decimal point, or 16 digits if used in 'Autopoint' mode. It used for fixed-point, decimal capacity of each register is mathematical sign and 31 digits.
Input Output External Storage:
Input: Console keyboard which activates computer or punches program or data tape.
8-channel program tape punch (also uses 5-channel tape).
8- or 5-channel data tape punch.
200-step control panel (for additional programming).
Output: Electric typewriter.
8-channel program tape reader (also uses 5-channel).
8- or 5-channel data tape punch.
Cathode ray tube.
Storage: None.
Maximum number of input output units: Four.

1620—(Maker—IBM United Kingdom Ltd)
Size: Small. *Price:* £30,000.
Applications: Engineering, scientific and mathematical problems.
Delivery: As required.

THE 1620 is contained in only two cabinets—one desk-size, housing the controls and calculating unit and an output typewriter; the other a compact paper tape unit.

Decimal notations and English words are used for input and output. Storage is an immediate access magnetic core with capacity of 20,000 digits.

Programs are stored on paper tape, feeding in at 150 characters per second. Output on the same medium is at 15 characters per second; or on the typewriter at 10 characters per second.

Programming can be learned in a few hours. The Fortran system (used on some other IBM computers) utilises one statement to embody many computer instructions. An alternative system, more suitable for some problems, is known as symbolic programming.

Other features include: fixed or variable length fields; built-in tables with all possible two-digit sums and products; performance of all arithmetic operations through automatic find and transfer answer routine; automatic sign control; a thorough automatic checking system.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 560 microseconds (5-digit factors).
Multiplication: 4960 microseconds (5-digit factors).
Division: Not given.
Branching: 200 microseconds.
Comparison: 200 to 560 microseconds.
Internal Storage:
Magnetic core. 20,000 digits. Immediate access. 300 positions permanently assigned for arithmetical use.
Input/Output/External Storage:
Input: Paper tape reader (8-channel tape). 150 characters per second.
Output: Paper tape punch (8-channel tape). 15 characters per second.
Automatic typewriter, 10 characters per second.
Storage: None.
Maximum number of input/output units: All, as listed above.

PCC—(Maker—ICT Ltd)
Size: Small. *Price:* £20,000.
Applications: Commercial data processing—*eg.* payroll, store, hire purchase and cost accounting, public utility billing.
Delivery: As required.

THE Programme Controlled Computer is designed to operate as an extension of the makers' 65- or 80-column electro-mechanical punched card systems. Comprising a single compact unit incorporating input and output channels, it adds an extra dimension to conventional systems—electronic speeds and a flexible programming procedure.

Input and output can consist of 130 or 160 columns of data, since interstage punching can be used on both card sizes. Print-out is off-line through a suitable tabulator.

Programs, which may have up to 160 steps, are prepared on prefabricated units, inserted by hand. Any number of sets of these boards (up to four boards per program) may be prepared and filed ready for immediate use at any time.

PCC. has a main store of 160 numbers each of 16 sterling or decimal digits and mathematical sign, and six immediate access stores of similar capacity. The computer works direct from sterling or decimal data punched into the cards, and uses denary arithmetic

SPECIFICATIONS

Arithmetic Speeds:
Governed by constant speed card feed—120 per minute.
Internal Storage:
Magnetic drum main store, 160 x 16 decimal digits and mathematical sign.
Six immediate access stores, each of 16 digits and sign.
Program units, 160 instructions and 40 built-in subroutines.
Input/Output/External Storage:
Input: 65- (130 with interstage punching) or 80- (160) column cards; 120 per minute.
Output: Punched cards, as for input, 120 per minute.
Storage: None.
Maximum number of input/output units: One of each.

555—(Maker—ICT Ltd)
Size: Small. *Price:* £25,000.
Applications: Commercial data processing—*eg.* stock records, payroll, public utilities billing.
Delivery: As required.

LIKE the same makers' PCC, the 555 is intended to extend the scope of a conventional electro-mechanical punched card system. Its internal storage, like that of the PCC., is on a magnetic drum with a capacity of 105 words of 10 digits each. Drum revolution speed is 3,000 per minute.

Input and output is by 80-column punched cards. For input, the cards may be inter-stage punched, the computer having a reading capacity of up to 150 columns of data. Maximum output capacity is 60 columns per card, leaving 20 columns for gang-punching of non-processed details.

Arithmetic speed is governed by input speed—100 cards per minute. In addition to performing all four standard arithmetical operations, the 555 is capable of extracting square roots. Card entries may be in decimal or sterling.

Programs are set up on pluggable control panels, inserted into the machine by hand. Any number of programs can be made up and kept on file for immediate use.

The computer is contained in three small cabinets, housing the controls, card reader-punch and computing unit.

SPECIFICATIONS

Arithmetic Speeds:
Governed by speed of card input—100 cards per minute.
Internal Storage:
Magnetic drum; 105 x 10-decimal-digit words; 3,000 revolutions per minute.
Input/Output/External Storage:
Combined input/output unit comprising 80-column card reader and punch. Input speed: 100 x 150 column cards per minute; output, 100 x 60 column cards per minute.
Storage: None.
Maximum number of input/output units: One combined unit.

1202—(Maker—ICT. Ltd)
Size: Small. *Price:* £50,000.
Applications: All types of commercial accountancy; local government, railway and central government work.
Delivery: As required.

THE 1202 system has superseded the 1201, an earlier machine in the same series no longer in production. Similar in construction to the 1201, the 1202 has a magnetic drum capacity nearly four times greater, and four quick-access stores instead of two.

There are four 1202 units—tabulator for input and output, electronic unit, automatic punch, and control console. Input is by 80-column punched cards, read at a speed of 100 per minute. Output may be through the automatic punch (100 cards per minute), the printer (85 lines per minute), or both units simultaneously.

Sterling, decimal, weight, time, or any other notation may be punched into input cards, this being automatically converted into binary arithmetic in the computer and results re-translated into the original system for output. Alternatively, input data may be punched in binary notation, thus increasing card capacity three-fold.

Punched cards are used for programming, and up to 12 instructions can be punched on each program card.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 1.25 milliseconds.
Multiplication: 20 milliseconds (average).
Division: 50 milliseconds (maximum).
Internal Storage:
Magnetic drum; 4,096 x 40-binary-digit words on 256 tracks of 16 words each. Transfer time 1.25 milliseconds.
Quick access stores. Four, each of 1 x 40-binary-digit word.
Input/Output/External Storage:
Input: 80-column card reader, punched in binary or denary notation. Read speed 100 cards per minute.
Output: Card punch; 100 cards per minute.
Line printer; 100 lines per minute.
Storage: None.
Maximum number of input/output units: One of each listed above.

802—(Maker—National-Elliott (see note below))
Size: Small. *Price:* £20,000.
Applications: Technical and scientific problems; process control.
Delivery: As required.
(*Note:* For other than scientific applications, contact The National Cash Register Co Ltd; for scientific applications, contact Elliott Bros (London) Ltd.)

SIMILAR in basic design to 803, the 802 has slightly faster arithmetic speeds, but a smaller internal storage capacity and cannot employ magnetic film.

Entire computer is contained in an L-shaped unit similar in size to an executive desk.

Basic input and output are punched paper tape; but punched card or keyboard input, analogue and digital recorders, or special devices made to users' specifications can also be employed.

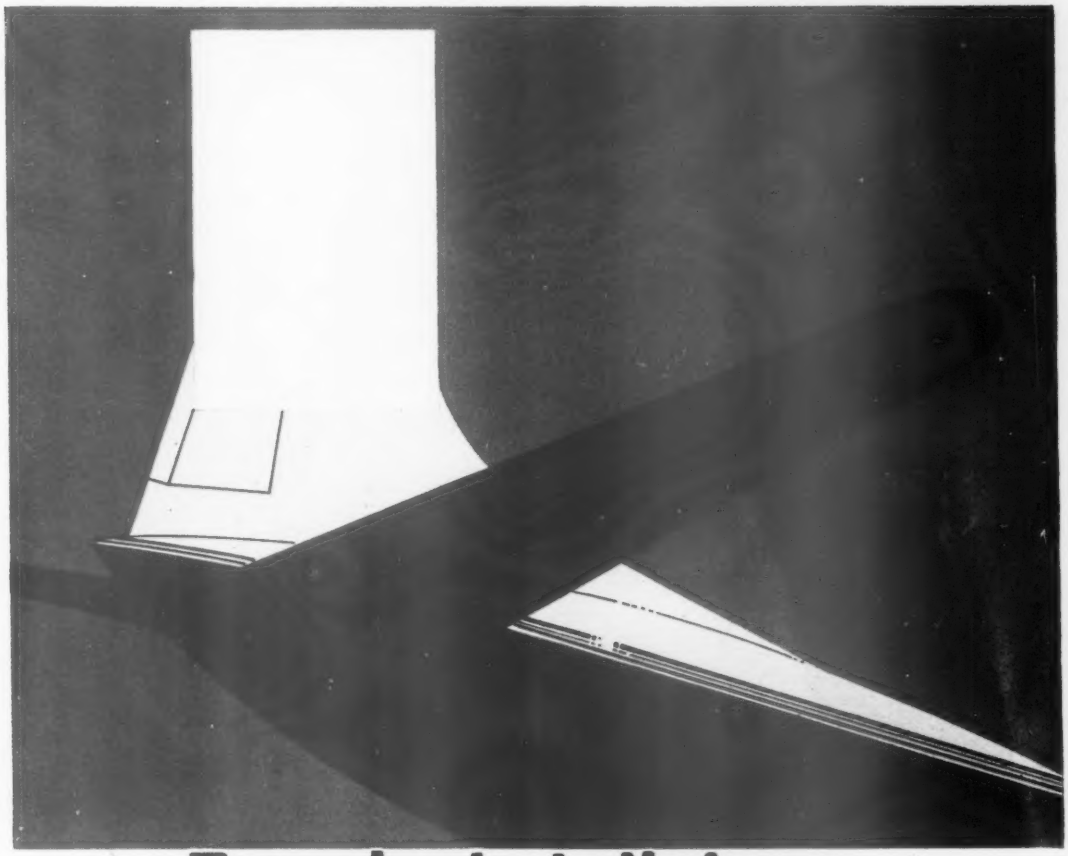
Only three keys are normally used in operation, these being mounted, with other controls, on a small central panel. The computer operates on a stored program and from a single level fast access store.

SPECIFICATIONS

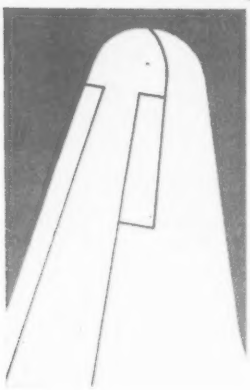
Arithmetic Speeds:
Addition & Subtraction: 0.612 milliseconds.
Multiplication & Division: 21.4 milliseconds.
Internal Storage:
Magnetic core; 1,024 x 33-binary-digit words. Access time included in instruction time and thus effectively zero.
Input/Output/External Storage:
Input: Paper tape reader; 140 characters per second.
Punched card reader; 100 cards per minute.
Console keyboard.
Output: Paper tape punch; 60 characters per second.
Storage: None.
Maximum number of input/output units: Two input, two output.

803—(Maker—National-Elliott (see note below))
Size: Small. *Price:* £28,000 to £100,000.
Applications: Commercial data processing—*eg.* stock control, sales analysis and invoicing, market surveys; mathematical and scientific problems generally.
(*Note:* For commercial applications, contact The National Cash Register Co Ltd; for scientific applications, contact Elliott Bros (London) Ltd.)

EXTENSIVELY transistorised, the 803 installation can be plugged into an ordinary mains supply; The computer itself occupies a single small cabinet, the (optional) magnetic file unit is equally compact.



Tuesday's tailplane



There is no doubt that the tailplane will be there on Tuesday - or that every other part and sub-assembly will be available on the scheduled date.
• The Bradma Production Control System is the manufacturer's complete assurance.

It is suitable for every type of organisation - large or small - whether manufacturing turbo-jets or children's bicycles.
• The Bradma Production Control System means improved efficiency.

In every Industry, manufacturing delays are possibly the most serious and costly hazard likely to be encountered.
• The Bradma Production Control System reduces this risk to the absolute minimum.

Normal production efficiency is improved when delays and transcription errors in the preparation of factory documents are eliminated.
• The Bradma Production Control System provides the means.

There are simple hand-operated models for the smaller user, and electrically powered models incorporating many auxiliary devices for the larger user. The great advantage of the System is its adaptability. It can always be designed to solve your own particular problem.
• The Bradma Production Control System has all these features PLUS.

Bradma

For full details, without obligation, enquire today.

ADREMA LIMITED, 2-10 TELFORD WAY, LONDON, W.3

The 803 is versatile, simple to use. Input may be through various punched card readers at different speeds, or paper tape reader. For output there are paper tape punches at various speeds, card punch, line printer. Other optional features include: automatic floating point arithmetic unit; up to four magnetic film mechanisms.

Only three control switches are used. The program code can easily be learned by users without previous experience; there is an extensive library of programs and sub-routines. Autocode system can be used.

Internal storage: fast-access magnetic core with expandable capacity.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 0.720 milliseconds.
Multiplication & Division: 29.520 milliseconds.
Internal Storage:
Magnetic cores; 1,024, 2,048 or 4,096 x 39-binary-digit words, according to model. Access time included in instruction time and thus effectively zero.
Input/Output/External Storage:
Input: Paper tape reader; 140 binary characters, 60 decimal characters per second.
Punched card reader; 100 or 200 cards per minute, according to model.
Console keyboard.
Output: Paper tape punches; 25, 60 or 100 characters per second, according to model.
Card punch; 100 cards per minute.
Storage: Up to four magnetic film mechanisms; each spool 1,000 feet, capacity 4,096 blocks of 64 words. Total capacity of system 262,144 x 39-binary-digit words.
Maximum number of input/output units: One paper tape input and one output channel, plus one other input-output channel.

LGP-30—(Maker—Royal-McBee)
Size: Small. *Price:* £18,000 to £20,750.
Applications: Engineering, technical and scientific work of all kinds; commercial data processing—*eg.* production and inventory control, payroll, sales analysis.
Delivery: Three months.

DESIGNED for mobility, LGP-30 comprises a single compact console mounted on castors. On a small extending shelf along one side of the console is an electric typewriter. Principally intended for engineering and technical problems, the computer can, with ancillary equipment, be applied to commercial data processing.

Standard input is through the alpha-numerical keyboard of the electric typewriter. Output is by punched tape or direct to the typewriter.

Ancillary input-output is available in the form of a photo-electric paper tape reader (200 characters per second) and a tape punch (20 characters per second). For storage, the computer has a magnetic drum with a capacity of 4,096 words and a speed of 3,600 revolutions per minute.

LGP-30 can also be used as a slave machine to a large scientific computer.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 0.26 milliseconds.
Multiplication & Division: 17 milliseconds.
Internal Storage:
Magnetic drum. Capacity 4,096 x 32-bit words.
Input/Output/External Storage:
Input: Input-output electric typewriter for alpha-numeric entries by punched tape or keyboard. Speed, 10 characters per second.
Ancillary photo-electric paper tape reader; 200 characters per second.
Output: Typewriter (see above).
Ancillary paper tape punch; 20 characters per second.
Storage: None.
Maximum number of input/output units: Three.

RPC-4000—(Maker—Royal McBee)
Size: Small. *Price:* £40,000 to £100,000.
Applications: Engineering and other technical and scientific problems; commercial data processing—*eg.* inventory and production control, payroll, job costing, market research.
Delivery: 1961.

FULLY transistorised, consisting basically of only two desk-size units, RPC-4000 runs from an ordinary 5-amp, 230-volt point. The machine is sufficiently versatile to be suitable for a variety of commercial applications in addition to a wide range of technical and scientific problems.

Magnetic drum store has a capacity of 8,008 words, and arithmetic speeds are high. Up to 17 input-output devices can be connected up simultaneously and, with slight modification, this number can be increased to 60. All are automatically controlled.

Standard input-output equipment is a typewriter, 7-channel paper tape reader and punch, which are combined into a single console unit. Reading speed is 60 characters per second; punching, 30 characters per second.

Optional equipment for expanding this basic system includes a reversible photo-electric paper tape reader with a speed of 500 characters per second; a 300-characters-per-second tape punch. Other peripheral equipment available by next year includes a magnetic tape unit and line printer.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 1 millisecond; 0.25 milliseconds for repeat operation after first.
Multiplication & Division: 18 milliseconds.
Internal Storage:
Magnetic drum: total capacity 8,008 x 32-binary-digit words made up as follows: main store 7,827 words, average access time 8.5 milliseconds; dual access store, 128 words, access speed 4-6 milliseconds after first access; high-speed line store, 8 words, access speed average 1 millisecond.
Input/Output/External Storage:
Input: Input-output Royal electric typewriter, punched tape reader and punch interconnected in any combination. Typewriter 12 characters per second, reader 60 characters per second, punch 30 characters per second; 7-channel tape.
High speed paper tape reader: 500 characters per second (optional feature).
Output: See first item under 'input'.
High speed paper tape reader: 300 characters per second.
Storage: None at present.
Maximum number of input/output units: Up to 17; or up to 60 with minor modifications.

Data processing equipment . . . fast flow of continuous stationery . . . bottleneck at end of processing line.
Install Bowe P1001 Electronic Guillotine . . . separation of forms keeps pace with flow . . . no more bottleneck.
The Bowe P1001 machine is a most versatile high speed unit, readily adapted to a series of operations. But we cannot convey a clear picture of it via this announcement so may we arrange for one of our technical people to call on you—when and where you wish.

Continuous and cut set stationery can be used in any office, but expert advice will help to make the best use of either. This service is freely offered by A. J. Catlin Ltd; why not find out what benefit it can be to you.

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ZEBRA—(Maker—Standard Telephones & Cables Ltd)
Size: Medium. *Price:* About £25,000.
Applications: Scientific and technical problems. Small commercial data processing schemes.
Delivery: As required.

ORIGINALLY designed for mathematical applications, Zebra is sufficiently flexible to operate with a variety of peripheral equipment. It is therefore suitable for commercial data processing schemes. The types of speeds of input and output equipment are not rigidly limited, so that the user can select those best suited to his needs.

Minimum basic unit comprises: control desk housing operating controls and input/output equipment—punched paper tape reader and teleprinter; the computing unit; and the power unit. The simplest form of extension allows for greater input/output facilities, that is, two tape readers; and two punches and/or two output printers. Among the alternative equipment available are higher-speed input readers, punched card readers, and faster on-line printers.

Two program codes are available—'normal' and 'simple'. The former, by making it possible for Zebra to carry out several functions simultaneously, results in higher working speeds than the specifications suggest. The simple code operates with numbers in floating decimal point form; is said to be one of the simplest for any British computer.

SPECIFICATIONS

Arithmetic Speeds:
Addition & Subtraction: 312 microseconds.
Multiplication: 11 milliseconds.
Division: 35 milliseconds.

Internal Storage:
12 immediate access stores, each 1 x 33-binary-digit word.
2 accumulating (add-subtract) registers.
Magnetic drum. Capacity 8,192 x 33-binary-digit words.
Average access time: 5 milliseconds. Maximum, 10 milliseconds.

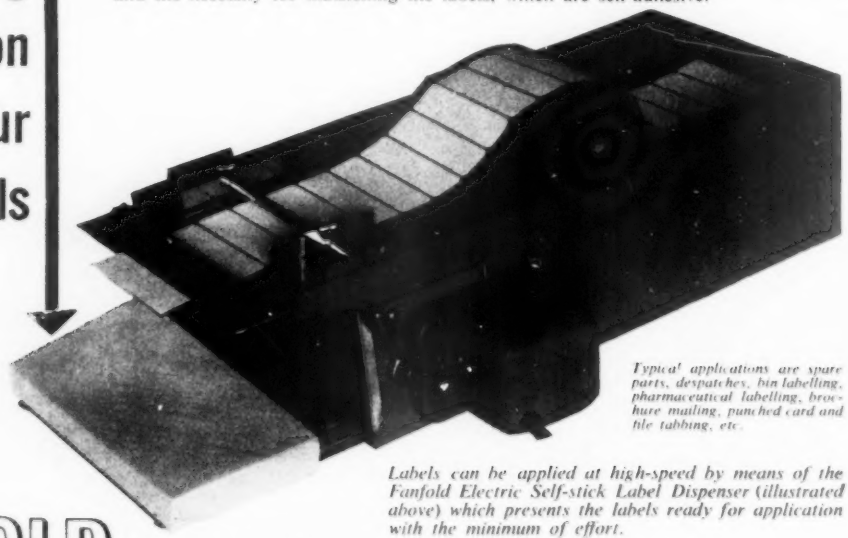
Input/Output/External Storage:
Input: One or two 5-channel paper tape readers, speed 100 characters per second. (Faster readers can be used.)
Output: 5-channel paper tape punch. Normal speed 50 characters per second. One other punch can be added. Alternative equipment has speed of 300 characters per second.
Teleprinter, 7 characters per second.
Storage: None.
Maximum number of input/output units: Two input, 2 output.

NEXT MONTH

Part III of the Survey of automatic data processing equipment and systems will review Facsimile Systems for transmitting data.

Bring automation to your labels

Fanfold Self-stick labels are produced in continuous forms on a sprocket punched backing sheet. By this method it is easy to produce labels on Automatic Data Processing Equipment from existing punched cards, paper tape or edge punched cards. This enables labels to be prepared at high speed by eliminating copy typing and the necessity for moistening the labels, which are self-adhesive.



Typical applications are spare parts, despatches, bin labelling, pharmaceutical labelling, brochure mailing, punched card and file tabbing, etc.

Labels can be applied at high-speed by means of the Fanfold Electric Self-stick Label Dispenser (illustrated above) which presents the labels ready for application with the minimum of effort.

FANFOLD for forms

Write for further details to
FANFOLD LIMITED, *Bridport Rd., London N. 18. Phone Edmonton 5404 (6 lines) Grams Bustforms, Norphone, London*
City Sales Office 74-75 Watling Street, London EC4. Phone City 3781
GLASGOW BIRMINGHAM MANCHESTER LEICESTER LEEDS CARDIFF DUBLIN

WHAT'S NEW

in systems, services and equipment

Off-line Printer

THE 'Universal', a high-speed off-line printer operating from magnetic tape, is another piece of equipment — from Remington Rand's Univac stable—which after initiation in the USA is to be made available in Britain. The Universal has a printing speed of 600 lines (of 130 characters) per minute, and incorporates several new plugboard control and internal editing features.

The magnetic tape unit reads alpha-numeric data in blocks of 120 characters and passes the information to the buffer memory store on the control unit, where it is stored temporarily and passed to the printer. The plugboard on the control unit directs the sequence of the printing, and controls the zero suppression, multi-line, and multiple printing operations. The control unit also houses the circuitry for controlling information flow and the power circuits for all the printer units. The printer has a range of 51 print characters available—26 alphabetical, 10 numeric, and 10 pica characters per inch horizontal and 6 lines per inch, single space (vertical). Double or triple spacing is also possible.

Built-in 'editing' features allow for zero-suppression, multiple and multi-line printing, form compensation, and single, double or triple spacing.

Doing single-line-only or multiple-only operations as many as 18 separate fields may be zero suppressed in this way; with combination printing the total rises to 36 fields.

A combination of multi-line and multiple printing will permit any character in a block to be printed on any combination of six lines or in any one of three columnar positions. In addition multi-line and single-line printing—one line only for each block of data—can be programmed by the plugboard to be interspersed on the same printing run.

Off-line Class Suppression

The class suppression feature facilitates selective printing as controlled by the data itself. Five 'classes' of information may be classified on the computer preparation run, and distinguished during the printing operation.

Form Compensation

Under form compensation (or fast feeding) the paper may be spaced past areas where no printing is desired from 1 to 66 spaces, at a rate of 20 inches per second.

For further information tick R01 on our reader enquiry coupon on page 40, or write to:
Remington Rand Ltd,
Remington House,
61-65 High Holborn,
London, EC1.

A Punching Printer

A METHOD of on-line card punching and printing which may — if adopted — revolutionise some companies' billing is being introduced by Remington Rand. Already it is widely used in the USA for insurance premium billing, pay cheques, stock dividend cheques, and magazine subscription fulfilment notices and bills.

The basic principle of the card punching printer is that a customer docket—an illustrated card, stock postcard, or standard tabulating card—can be prepared, punched, verified and printed on both sides —in a single output run.

Edits data, prints off-line

The operation of the card punch printer is as follows:

1—Blank cards are stacked in the input magazine and are fed into the punch section under control of the program. Cards are passed through the pre-punch station to the punch station where up to 80 digits of alphabetic or numeric data are simultaneously punched into the card in pre-selected areas.

2—From the punch section the card passes through a 'wait' station to the read-verify station, where the punched data is read and verified.

3—Thereafter it passes through another wait station to the card stop gate and from there to the print section. The input of documents and punching and checking operation proceeds at a maximum speed of 150 dockets per minute.

The print section of the card-punching printer consists of two print stations each with an instantaneous printing speed of 900 lines—or 63,000 characters—per minute. At the first station up to 13 lines of information can be printed, each line being up to 20 alphabetic or numeric characters. The card then passes to the second print station where the cards are printed on the reverse. The punched and printed dockets thence proceed to the output stackers, which operate under the control of the program. There are three stackers designated 2, 1, and 0, each with a capacity of 1,000 cards. If no stacking program instructions are specified, the cards are stacked automatically in the no. 2 stacker.

The various operations occur simultaneously, under a stored program of instructions.

For further information tick R02 on the reader enquiry coupon on page 40, or write to:
Remington Rand Ltd.
Remington House,
61-65 High Holborn,
London, EC1.

Type, tape or punch?

AN equipment which provides a three-way recording of data at the closest point to the business transaction is the 870 Document Writing System, recently developed by IBM.

'Six-in-Hand'

In this system one operator is able to produce information as typewritten copy, punched cards and paper tape. Moreover the input/output combination can be such that the data can be introduced by all or any of three media. In this way companies with many distribution points and central data processing may feed in data in the form most convenient to them.

In the same way the equipment can process information for several different applications with the same order cycle, typing customer orders, printing stock selection tags, and punch paper tape and cards for computer input. Another feature of the combination is that selected parts of the information can be recorded on the different media simultaneously. The control of the system is a wired panel which establishes the combination and selectivity of data processing, input and output.

For further information tick R03 on the reader enquiry coupon on page 40, or write to:
IBM (United Kingdom) Ltd.
101 Wigmore Street,
London, W1.

Reader Enquiry Service

From WHAT'S NEW
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Please advise me on the following additional problem

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Company

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Address

NOW MAIL THIS COUPON TO: AUTOMATIC DATA PROCESSING, *Reader Enquiry Service, Mercury House, 109-119 Waterloo Road, London, SE1*

is punched tape really the best input medium for numerical control?

Although 8-channel punched paper tape is only one of several numerical control input media, it is fast becoming the standard with builders of numerically-controlled machine tools. Why the swing to punched paper tape? There are three fundamental reasons:

(machine toolmakers say yes!)

1. Paper tape coding is visible, tangible. You can see it, touch it, and with practice even read it.
2. Paper tape is continuous. Unlike cards, it can't get out of order.
3. Paper tape is easy to programme — preparation, verification, and reproduction of tapes are all handled on one inexpensive machine, the Friden Flexowriter.

For the machine tool buyer, standardization on paper tape means great savings. It's so much easier (and less expensive) when *one* input system can control *all* of the numerically-controlled machines in a given plant.
If you're thinking numerical control, you'll do well to think *punched paper tape*.

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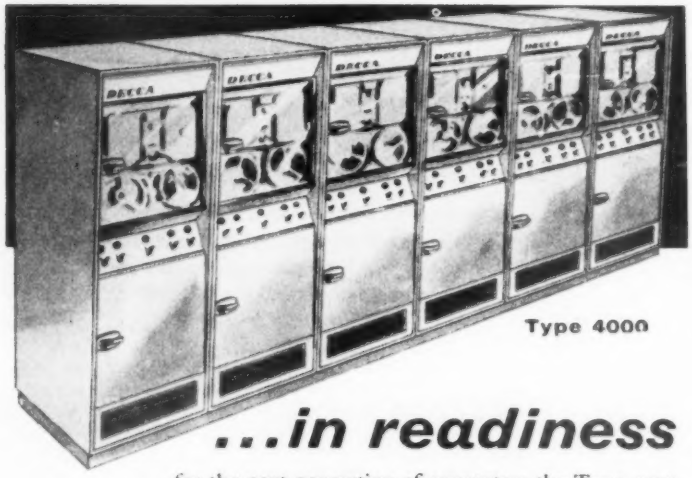
PTV

DECCA magnetic tape systems



Type 4000

...in readiness

for the next generation of computers the Type 4000 Tape Unit, embodying many novel features, is already in the advanced stages of development.

in service with today's great digital computers, 40 Type 3000 Computer Magnetic Tape Units (comprising 80 tape transports) have been delivered to leading computer manufacturers and laboratories:

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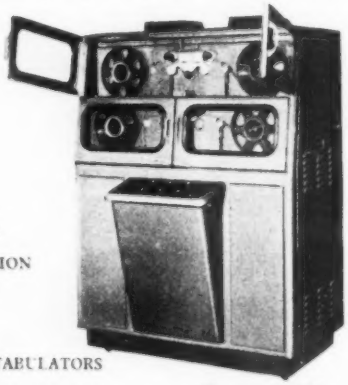
FERRANTI LTD.
BANK PRECISION LTD.
NATIONAL ELLIOTT
ASSOCIATED ELECTRICAL INDUSTRIES
ROTHAMSTEAD EXPERIMENTAL STATION
NATIONAL PHYSICAL LABORATORY
GOVERNMENT LABORATORIES
INTERNATIONAL COMPUTERS AND TABULATORS
UNIVERSITY MATHEMATICAL LAB., CAMBRIDGE



Type 3000

EDSAC II LEO II PEGASUS DEUCE II
ELLIOTT 401 A.E.I. 1010 ACE DEUCE I

DECCA RADAR

For further information, please write to:
DECCA RADAR RESEARCH LABORATORIES
Hersham Trading Estate, Walton-on-Thames, Surrey
DR135a

New Photo-copying process

A RADICALLY new photo-copying process—surface-application—is incorporated for the first time in a commercial photocopier, the Buromatic. This method requires no negatives, and uses high efficiency chemicals, so that instead of being totally immersed, the prints are merely passed over wet rollers. In this way high speed copying—8 seconds per print—is achieved at a cost of no more than 3d a copy.

The original and copy paper, which may be of dimensions up to 16 inches by 13 inches, are first exposed to light in the exposer—the automatic timer determining the length of exposure—and then processed by insertion in the entry aperture of the processing section.

For further information tick R04 on the reader enquiry coupon on page 40, or write:

Solicitors' Law Stationery Society,
Oyez House,
Norwich Street,
London, EC4.

Keyboard Machine Punches Cards

MERCEDES STERLING, who market a range of electric accounting machines and typewriters with built-in paper tape punch equipment, have now introduced an all-electric accounting machine coupled to a motorised card punch.

The accounting machine allows for the automatic printing of dates, balances and columnar totals and may be provided with up to 20 totals. A form bar will enable the automatic selection to be made of information for punching on the cards.

Any make of motorised card punch may be linked to the accounting machine, allowing punched cards for any tabulator to be prepared simultaneously with

Activates card punch

conventional accounting records. Cost of the equipment depends on the card punch selected and the versatility of the accounting machine chosen, but Mercedes reckon that the cost will be £250-£400 plus the cost of the accounting machine: *ie*. £900-£1,800.

For further information tick R05 on the reader enquiry coupon on page 40, or write to:

Mercedes Sterling Book-keeping and Calculating Machines Ltd.
11 Ludgate Circus,
London, EC4.

For Quicker Output

AN integrated unit attachment for tape operated electric typewriters which it is claimed will speed operation and cut down on programming time and economise on tape space, is announced by Lamson Paragon.

When operating with tape operated machines a suitable tape code is selected which provides an electrical impulse to activate each throw. The line-finder stops the form in the right position, so that typing can begin immediately on the next group of information. Fast and positive vertical movement is assured, and time saving should be considerable.

For further information tick R06 on the reader enquiry coupon on page 40, or write to:

Lamson Paragon Ltd.
Paragon Works,
Canning Town,
London, E16.

We hear . . .

. . . Scientific Furnishings Ltd of Poynton, Cheshire, are importing the El-Con system for low-level data acquisition using electro-logic transponders, a significant advance in data systems and process control.

. . . Aveley Electric Ltd are marketing a new fast repetition pulse generator, the Du Mont 404, for circuiting development and ultra-high frequency studies . . .

Open letter to LT

Our correspondent writes to a former colleague whom he fears may have missed last month's BEE.

Once again it was the Grand Hall. Admired the huge railway-station-like roof and made a resolution to visit only stands *that were carpeted*. Much kinder on the feet. Thought I must be asleep on them when stumbled on a well-preserved skeleton revolving on a revolving chair. Realised in time it was a *gimmick*—not a symbol of the office equipment industry's health.

Approached the Bulmer stand and found an omniscient Scot—omniscient, that is, about the products of his division. I had forgotten the Wegematic system—you know, storage drum and Addo book-keeping machine: all for £8,000. The basic equipment is a bit *ad hoc* as a solution to the storekeeper's problem, but by adding enquiry stations and paper tape readers it should be possible to link it up with other equipment. Did you know Bulmer's systems people do a lot of adapting of various Addo machines to suit individual customers, and in some cases are well ahead of the Addo company itself in developments?

Was shown one trick that has already sold—an adding machine coupled to an alpha keyboard (wrenched from some IBM machine, it seems) which produces a print out and control totals and a punched tape.

★ ★

On to Adrema stand. Discreetly in the background was stationed a Farrington optical scanner. Mr Moss did the honours. Take card (US service station bill, for example) and plastic plate with customer's name and number embossed on it. Put card and plate in little machine, crank handle and record is made. Put card in Farrington reader, which *reads* the customer number, performs one or two ingenious checks on its reading and then punches out what it has read in the same card. Scanner has novelty value. Too early to say whether there will be any takers. Adrema have produced an electronic calculator, using, I think, embossed places for input, but although went up to within kicking distance of it, could find no one to demonstrate. Lots of bods ready to show other things—in fairness.

★ ★

With punched tape still in mind went to the Underwood stand to ask about Dataflo. Polite gentleman told me it had been withdrawn. Pity, that.

★ ★

IBM main stand arranged on several levels, giving the impression of being on a streamlined yacht. Went up on bridge and looked down on the 1401 computer. Decided that all computer demonstrations are unspectacular—always have cards (or tape), will have

print-out.' Met Mr Fitzpatrick, who provided the biggest batch of literature so far.

★ ★

Stepped gingerly on to ICT stand; lots of girls all similarly dressed for easy identification, none of them gave me a second glance. The Special Products Division reveal some real back-room stuff. Large cue boards to tell you what it did. Small information sets developed for punching a card from remote points will be used by the Mayfair Hotel for making entries to hotel bills. Basically, a data collection system, similar in concept to Friden's Collectadata shown by Bulmers, and to the IBM 357 system. Visited latter on IBM's first-floor stand.

Closed circuit television beamed on to equipment to allow operations to be seen downstairs. Basic idea is that you have card input stations dotted around your workshops in strategic positions, where your workers can clock in and can also record job times 'Put on machine at x pm. Completed at y pm.' Also useful for inspection reports, and material issuing. The card input units can be at a range of one mile from central output station. On the IBM stand the output station was on the ground floor, with another input on first floor, situated beside the central output station.

★ ★

Now demonstrator goes to show job reporting. Card of employee fed into letter box, and also card of job. Keyboard depressed for good measure. Machine fails to register. Something wrong with output punch. 'Must be the heat of TV cameras' says demonstrator, telephoning for the German engineer attached to other IBM stand. 'Why German?' I ask. Seems they have most operational experience of this machine—developed for Volkswagen works. English engineer comes up, adjusts the machine. Cards begin to flow again. All well. Demonstrator now shows how even badly crumpled cards can be used in the input station. Card punch fails again. Adjustment again made and operation goes smoothly. 'The first time it's let me down', says operator, perspiring faintly under the arc lights. Thank him and move on.

★ ★

Go on Ferranti stand. No equipment, just model representations of Pegasus and Orion. Lift up telephone, dial 'O' and hear a bloodless voice telling how computer works. Saw large newsboard announcing £300,000 order by Beecham Group for an Orion data processing system. Hot news, so asked for handout. Considerable Alarm. Yes, there must be one. No, none here. So sorry. Move down stand. Little alcoves with programmers busy at work. Chat to programmer Nicoll. Just packing to go Australia, to lay foundations of Melbourne computer centre. Two-man office now, Sirius coming later. Programmer liked being on first floor. Quieter, able to do some work. Better quality of enquiries—only people really interested seek you out.

★ ★

Pass on to Royal-McBee stand. Great enthusiasm around the typing 'competition' stand but little LPG-30 computer standing lonely and unloved. Managed to find demonstrator. 'Can't think why you are interested in this computer. It's not new'. Looked at controls. Half the equipment has instructions in German. 'We decided to put that bit on at the last minute. Didn't have time to make alterations.' This computer demonstrator says that it is useful for people who want equipment which is low-priced, small, reliable, and slow. Used by Bonn University and on semi-scientific work in Germany. Has commercial applications, of course. Several enquiries that very afternoon for production control; among them a light engineering firm, and a government department. Two orders pending for this computer in UK but would not say the prospective buyers. Might be unlucky.

★ ★

Went on NCR stand late in the day. Saw demonstration of Computronic combined system—simultaneous invoice and statement preparation and paper tape punching as used in Bryant and Mays. Ingenious but complicated to operate, at least to the outsider. Saw the National Elliott 803 in action and argued whether it would be classified as a small or medium-sized computer. 'After all' said the demonstrator 'It's *only* £28,000!' He said that a large sale had been concluded on the first day of the Exhibition—'Can't mention names, old boy'—and that two more were pending and should 'break' in a matter of days or weeks. Asked for information officer Peter Spooner. 'Mr Spooner? I don't know him. We're all salesmen here'.

★ ★

Time for a drink, but still to visit Creed stand. Duty before drink—besides David Barker might have one with me. On Creed stand Barker very much in demand. On display, one of the paper tape storage decks as used in Shell-Mex and BP's automatic office (see AUTOMATIC DATA PROCESSING, October issue) and a photo-electric edge-punched card reader developed by Creed's German associates, Standard Elektrik Lorenz; but demonstrator unsure why it is being exhibited. Creedomat on show again—an electric typewriter that will punch a paper tape as well as be activated by one. Must probe into applications for this equipment, but not today. Barker still busy, so went to have gin-and-tonic alone.

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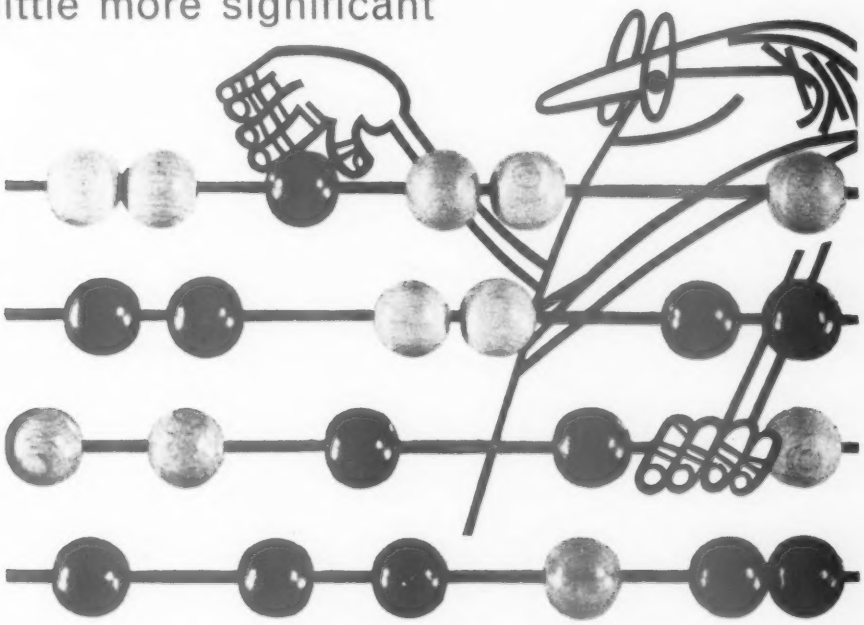

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